COMMONWEALTH OF PENNSYLVANIA.

DEPARTMENT OF INTERNAL AFFAIRS.

THOMAS J. STEWART,
Secretary.

ISAAC B. BROWN,
Deputy Secretary

PETROLEUM,

Its Production and Products

—IN—

PENNSYLVANIA.

SECTION B.

ANNUAL REPORT OF THE BUREAU OF INDUSTRIAL STATISTICS, 1892.

ALBERT S. BOLLES,
Chief of the Bureau.

HARRISBURG:
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[Table A.]

EXPORTS OF PETROLEUM.

Year Ending June 30th.	Gallons Exported.	SCALE: ONE INCH PER 100,000,000 GALLONS.
1864	23,210,369	
1865	25,496,849	
1866	50,987,341	
1867	70,255,581	
1868	79,456,888	
1869	100,636,684	
1870	113,735,294	
1871	149,892,691	
1872	145,171,583	
1873	187,815,187	
1874	247,806,483	
1875	221,955,308	
1876	243,660,152	
1877	309,198,914	
1878	338,841,303	
1879	378,310,010	
1880	423,964,699	
1881	397,660,262	
1882	559,954,590	
1883	505,931,622	
1884	513,660,092	
1885	574,628,180	
1886	577,781,752	
1887	592,803,267	
1888	578,351,638	
1889	616,195,459	
1890	664,491,498	
1891	710,124,077	
1892	715,471,979	

PETROLEUM, ITS PRODUCTION AND PRODUCTS.*

ANALYSIS.

* Prepared, at request of the Bureau, by H. C. Folger, Jr.

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PART II.—PETROLEUM PRODUCTS.

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INTRODUCTION.

Petroleum is a product of peculiar interest to the people of Pennsylvania. Although to-day a part of the crude material is mined in some of the adjoining states and a considerable portion of the refining is done outside the boundaries of our commonwealth, we can justly claim that the home of the industry has been, and still is, here. Few of us, familiar as most are with the sight of oil derricks and trains of tank cars, comprehend the phenomenal growth and present magnitude of petroleum production and manufacture. If any one questions this statement, he surely will not after an attentive reading of this report.

Scarcely thirty years have passed since the first still was charged with petroleum, and the first barrel of refined oil offered for sale; yet the exports already rank fourth in the list for value, being surpassed only by cotton, breadstuffs and provisions; while, in our own country nearly every home is blessed with petroleum's beneficent light. For the year ending June 30, 1864, only twenty-nine years ago, the total exports were 23,000,000 gallons. By 1869, they had grown to 100,000,000 gallons; by 1874, to 200,000,000 gallons; by 1877, to 300,000,000 gallons; by 1880, to 400,000,000 gallons; by 1882, to 500,000,000 gallons; by 1889, to 600,000,000 gallons; by 1891, to 700,000,000 gallons. To-day a larger percentage of the oil product of the country is sent abroad than of any other product except cotton.

The growth in exports of illuminating oils is still more marked. Those for the year ending June 30, 1866, were three times those of 1864; those of 1868, twice those of 1866 and six times those of 1864; those of 1871, twice those of 1868 and twelve times those of 1864; those of 1877, twice those of 1871 and twenty-four times those of 1864; those of 1891, twice those of 1877 and forty-eight times those of 1864; those of 1892, over fifty times those of 1864. In other words, beginning with 1866, the exports of illuminating oils were doubled in 1868, again in 1871, again in 1877 and again in 1891; so that those of 1891 were twice those of 1887, four times those of 1871, eight times those of 1868, sixteen times those of 1866 and forty-eight times those of 1864. The average exports per week in 1892 were as much as for the entire year of 1864. The world has reason to be thankful for Pennsylvania petroleum.

We are especially impressed with this thought when, in the light of the great growth in business, we study the reduction in prices. Export oil averaged in 1861, $61\frac{1}{2}$ cents per gallon; in 1871, $23\frac{5}{8}$ cents per gallon; in 1881, 8 cents per gallon; in 1891, $6\frac{7}{8}$ cents per gallon; in 1892, 6 cents per gallon, or less than one-tenth that in 1861. But this decrease, great as it is, does not represent the real reduction in the price of oil; as the cost of the barrel is included in these prices. A gallon of bulk oil cost

in 1861, not less than 58 cents; in 1892, not more than 3½ cents, or hardly one-seventeenth. In January, 1861, the price was 75 cents; in January, 1892, 3 cents, or one-twenty-fifth that of thirty-two years ago. The money that, in 1861, was required to buy a thousand barrels of oil, will to-day purchase twenty-five thousand barrels.

Enormous capital and energy have been required to establish an industry of such magnitude. Pipe lines aggregating 25,000 miles in length—a girdle for the globe—and 9,000 tank cars—placed end to end, an unbroken train extending two-thirds the distance between Harrisburg and Philadelphia, or three-fourths that between Philadelphia and New York—helped in moving the products to the home markets; while 59 bulk steamers, not to mention bulk sailing vessels and the fleet of steamers and ships carrying oil in barrels and cases, transported them to the most distant quarters of the earth. Petroleum undoubtedly has a wider sale than any other American product. Where commerce has made its way it has found a welcome. "It is carried wherever a wheel can roll or a camel's foot be planted. The caravans on the Desert of Sahara go laden with Astral oil, and elephants in India carry cases of Standard White. Ships are constantly loading at our wharves for Japan, India, and the most distant isles of the sea."

The able special agent on petroleum for the Eleventh United States Census estimates the value of Pennsylvania oil wells and land at over $87,000,000, and shows that the investment in plant employed in the production of crude petroleum will bring this sum up to $150,000,000. This does not include the value of pipe lines, nor of tank cars, nor of the great fields of tankage for the storage of crude, nor of the costly refineries, nor of the terminals and docks at the sea-board for export shipments, nor of the fleet of bulk vessels carrying the product to foreign shores. The census report, when published, will give the value of refineries as over $75,000,000. We think it no exaggeration to estimate the total capital required for the production, manufacture and transportation of petroleum and its products at $300,000,000.*

*In preparing this report our indebtedness is acknowledged to the admirable *Geology of the Oil Region* by Mr. J. F. Carll, published as part of the Second Geological Survey of our state; to the comprehensive report on petroleum by Prof. S. F. Peckham for the Tenth United States Census; to much valuable information furnished us in advance of his report on petroleum for the Eleventh United States Census by Mr. J. D. Weeks; and to the uniform courtesy of the officers of the various branches of the Standard Oil Company, without whose aid this article would have been far from complete. We have been helped also by nearly all of the books mentioned in our list on the literature of petroleum.

[TABLE B.] GENERAL STATISTICS OF THE PETROLEUM INDUSTRY.

YEAR	CRUDE OIL.					Refined oil—Average price paid per gallon in barrels for export at New York.	EXPORTS—FISCAL YEAR ENDING JUNE 30.	
	Production (barrels of 42 gallons).	Shipments (barrels of 42 gallons).	Stocks, close of year (barrels of 42 gallons).	Number of wells completed.	Price at wells per barrel.		Total quantity (gallons).	Total value.
1861.	2,113,600	1,650,133	Unknown.	Unknown.	$0 52	$0 61½	Unknown.	Unknown.
1862,	3,056,606	3,101,571	Unknown.	Unknown.	1 00	36⅜	Unknown.	Unknown.
1863.	2,611,359	3,242,951	Unknown.	Unknown.	3 11	44¼	Unknown.	Unknown.
1864,	2,116,182	1,842.061	Unknown.	Unknown.	7 85	65	23,210,369	$10,782.689
1865,	3,497,712	2,100,132	Unknown.	Unknown.	6 59	58¾	25,496,849	16,563,413
1866,	3.597,527	3,010,921	Unknown.	Unknown.	3 74	42½	50,987,341	24,830.887
1867.	3,346.306	2,393.210	534,000	Unknown.	2 41	28⅜	70,255,581	24,407,642
1868,	3,715.741	3,482,510	264,805	Unknown.	3 62½	29½	79,456,888	21.810.676
1869,	4,186,475	4,255,343	340,154	Unknown.	5 63¾	32¾	100,636,684	31,127.433
1870.	5.308,046	5.593,168	537,751	Unknown.	3 84	26⅜	113,735,294	32,668,960
1871,	5,205,234	5,664,791	532.000	Unknown.	4 47	24½	149,892.691	36,894,810
1872,	6,293.194	5,899,947	1,084,423	1,183	3 95	23⅝	145.171,583	34.058,390
1873.	9,893.786	9,499,775	1.625.157	1,263	1 73	17⅞	187.815,187	42.050,756
1874.	10,926,945	8,821.500	3,705.639	1.317	1 18	13	247.806.483	41,245,815
1875.	8,787,514	8.942.938	3.550,207	2,398	1 25	13	221,955.308	30,078,568
1876.	8,968.906	10,164.452	2,551,199	2,920	2 51	19½	243.660,152	32.915,786
1877.	13,135,475	12,832,573	3,127,837	3,939	2 39	15½	309.198.914	61,789,438
1878,	15,163,462	13,676,000	4.615,299	3,064	1 16	10⅜	338,841.303	46.574,974
1879,	19,685.176	15.886,470	8.470.490	3,048	88	8½	378,310.010	40.305,249

[TABLE B.] GENERAL STATISTICS OF THE PETROLEUM INDUSTRY—*Continued.*

YEAR.	CRUDE OIL.					Refined oil—Average price paid per gallon in barrels for export at New York.	EXPORTS—FISCAL YEAR ENDING JUNE 30.	
	Production (barrels of 42 gallons.	Shipments (barrels of 42 gallons).	Stocks, close of year (barrels of 42 gallons).	Number of wells completed.	Price at wells per barrel.		Total quantity (gallons).	Total value.
1880,	26,027,631	15,677,492	18,928,430	4,217	$0 94⅛	$0 09	423,964,699	$36,218,625
1881,	27,376,509	20,284,235	26,019,704	3,880	85½	8	397,660,262	40,315,609
1882,	30,053,500	21,900,314	34,596,612	3,304	78⅝	7⅞	559,954,590	51,232,706
1883,	23,128,389	21,979,369	35,745,632	2,847	1 06¼	8	505,931,622	44,913,079
1884,	23,772,209	23,657,597	37,366,126	2,265	83¾	8⅛	513,660,092	47,103,248
1885,	20,776,041	23,713,326	34,428,841	2,761	88½	8	574,628,180	50,257,947
1886,	25,798,000	26,653,852	34,156,605	3,478	71¼	7⅛	577,781,752	50,199,844
1887,	21,478,883	27,279,028	28,006,211	1,660	66⅝	6¾	592,803,267	46,824,933
1888,	16,488,668	25,138,031	18,995,814	1,515	87	7⅛	578,351,638	47,042,409
1889,	21,487,435	29,638,898	11,562,593	5,435	94	7⅛	616,195,459	49,913,677
1890,	30,065,867	30,116,075	9,993,600	6,437	86½	7⅜	664,491,498	51,403,089
1891,	35,742,152	30,193,940	15,354,233	3,390	66¾	6¾	710,124,077	52,026,734
1892,	33,332,306	31,048,944	17,395,389	1,954	55⅝	6	715,471,979	44,805,992

PART I. PETROLEUM PRODUCTION.

HISTORICAL SKETCH.

Early History.—Drake's Well.—Development since 1859.

Early History.—It is impossible to state when petroleum was first discovered. In some form it seems to have been applied to the uses of mankind from the earliest periods known to history. The "slime" of Old Testament Scripture, mentioned as the mortar used in constructing the Tower of Babel, 2,200 years before Christ (Gen. xi, 3), was probably partially evaporated petroleum; and the "pitch" with which Noah coated the ark, 250 years earlier (Gen. vi, 14), was doubtless a similar product.

The ruins of Nineveh and Babylon indicate that the asphaltic cement used for their walls and buildings was composed, in part at least, of semi-fluid bitumen. Herodotus wrote: "Eight days' journey from Babylon stands another city called Is, on a small river of the same name, which discharges its stream into the Euphrates. Now this river brings down with its water many lumps of bitumen, from whence the bitumen used in the walls of Babylon was brought." The same writer elsewhere (I, 119) speaks of the oil springs in the island of Zante: "I have myself seen pitch drawn out of the lake and from water in Zacynthus." This was about 500 B. C.

In the first century before Christ, Strabo refers to the bitumen from the region of the Dead Sea sold the Egyptians for embalming; and this is confirmed by Diodorus Siculus, the Greek historian, who describes the collection of this asphalt and the commerce in it with Egypt. Aristotle, and later, Josephus, Pliny, and Plutarch make mention of the deposits found in Albania on the Adriatic sea. The holy fires of Baku on the Caspian, the home of the fire god, have been known and worshipped for at least twenty-five centuries. Six hundred years before Christ this spot was the goal of pilgrimages even from India. (See Vigne's *Travels in Kashmir and Little Thibet;* also Marvin's *Region of Eternal Fire.*)

Perhaps the first mention of the use of petroleum for illuminating purposes is the "Sicilian oil", described by Pliny, the historian, and Dioscorides Pedanius, the Greek botanist, as secured near Agrigentum, now called Girgenti, on the island of Sicily, to be remembered as the site of the temples of Concord and of Olympian Jupiter. This oil was burned in lamps as early as the beginning of the Christian era.

It would not be difficult to continue this record and show that from

the periods already mentioned down to the establishment of petroleum as a staple article of commerce, there is an unbroken line of evidence that travellers found it in almost every quarter of the globe. But it is of especial interest, we think, to note, as we have done, the great antiquity of its use.

In America the Indians collected what was known as "Seneca oil" from petroleum springs; and the indications are that, long before them, the Mound Builders who worked the copper mines of Lake Superior, the lead mines of Kentucky, and the mica mines of North Carolina, not only gathered the oil that flowed from natural springs and appeared on streams, but even dug numerous wells in our own state, Ohio and Canada, and dipped up the petroleum that flowed into them. Trees, now growing in the earth thrown out in digging the wells, or in the wells themselves, show that this work was done from 500 to 1,000 years ago. Prof. S. F. Peckham, in his exhaustive report for the Tenth United States Census (to which we are indebted for much valuable information), states that the earliest mention that has come to his notice of petroleum in America is that of 1629; when Joseph de la Roche D'Allion, a Franciscan Missionary, crossed the Niagara river from Canada into what is now New York. He wrote back of the oil spring known to the Indians. The name which they had given the place was significant, meaning "there is plenty there." This letter, he says, was published in Sagard's *Histoire du Canada*, 1632, and afterwards in *Le Clerc*. We learn from *Stowell's Petroleum Reporter* that, in 1721, Charlevoix, the French historian and missionary to Canada, who, among other exploits, descended the Mississippi river to its mouth, quotes Captain de Joncaire as stating that there is a "fountain at the head of a branch of the Ohio" (the Allegheny river, no doubt) "the water of which is like oil, has a taste of iron, and serves to appease all manner of pain." We must take space for the following from the first volume of the *Massachusetts Magazine*, issued in 1789:—

"In the northern part of Pennsylvania is a creek called Oil creek, which empties into the Allegheny river. It issues from a spring on which floats an oil similar to that called Barbadoes tar, and from which one may gather several gallons a day. The troops, sent to guard the western posts, halted at this spring, collected some of the oil, and bathed their joints with it. This gave them great relief from the rheumatism with which they were afflicted. The water, of which the troops drank freely, operated as a gentle purge."

In Henry's *Early and Later History of Petroleum*, a letter from the commander of Fort DuQuesne, written to General Montcalm in 1750, is given, showing not only the medicinal qualities that had been found efficacious in the springs of Oil creek and the neighboring country, but the employment of the oil for religious rites much like those in vogue on the Apsheron peninsular in the Caspian sea, of which mention has already been made:—

"I would desire to assure you that this is a most delightful land. Some of the most astonishing natural wonders have been discovered by our people. While descending the Allegheny, fifteen leagues below the mouth of the Conewango and three above the Venango, we were invited by the chief of the Senecas to attend a religious ceremony of his tribe. We landed, and drew up our canoes on a point where a small stream entered the river. The tribe appeared unusually solemn. We marched up the stream about half a league, where the company, a band it appeared, had arrived some days before us Gigantic hills begirt us on every side. The scene was really sublime. The great chief then recited the conquests and heroism of their ancestors. The surface of the stream was covered with a thick scum, which, upon applying a torch at a given signal, burst into a complete conflagration. At the sight of the flames, the Indians gave forth the triumphant shout that made the hills and valleys re-echo again. Here, then, is revived the ancient fire-worship of the East; here, then, are the Children of the Sun."

Soon after the opening of the present century, the boring of wells for brine from which to make salt was successfully undertaken. At Tarentum on the Allegheny river some of these wells were operated before 1810, but the first borings were made on the Kanawha river in West Virginia, if we accept the claims of Dr. J. P. Hale in the article he prepared for Professor M. F. Maury's book on the resources and industries of that state.

Salt and oil have so often been found in the same geological formation that scientists have tried to account for them as of one origin. These West Virginia salt wells become of interest to us when we note that oil appeared in all of them, and was a source of considerable annoyance. Dr. Hale describes the efforts of two Ruffner Brothers, beginning in 1806, to put down deep wells for salt; resulting in a bore of nearly 60 feet, soon followed by other and deeper borings. The item of interest to us is the following:—

"Nearly all the Kanawha salt wells have contained more or less petroleum, and some of the deeper wells a considerable flow. Many persons now think, trusting to their recollections, that some of the wells afforded as much as 25 to 50 barrels per day. This was allowed to flow over from the top of the salt cisterns to the river, where, from its specific gravity, it spread over a large surface, and by its beautiful iridescent hues and not very savory odor could be traced for many miles down the stream. It was from this that the river received the nickname of 'Old Greasy,' by which it was for a long time known by Kanawha boatmen and others."

A valuable reference to petroleum is found in Dr. S. P. Hildredth's article published in 1833, in the *American Journal of Science and Arts*:—

"Since the first settlement of the regions west of the Appalachian range the hunters and pioneers have been acquainted with this oil. Rising in a hidden and mysterious manner from the bowels of the earth, it soon arrested their attention, and acquired great value in the eyes of these simple sons of the forest. Like some miraculous gift from heaven, it was thought to be a sovereign remedy for nearly all the diseases common to those primeval days, and from its success in rheumatism, burns.

coughs, sprains, etc., was justly entitled to all its celebrity. It acquired its name of Seneca oil, that by which it is generally known, from having first been found in the vicinity of Seneca lake, New York. In the neighborhoods where it is abundant it is burned in lamps in place of spermaceti oil, affording a brilliant light, but filling the room with its own peculiar odor. By filtering it through charcoal much of this empyreumatic smell is destroyed and the oil greatly improved in quality and appearance. It is also well adapted to prevent friction in machinery, for, being free of gluten, so common to animal and vegetable oils, it preserves the parts to which it is applied for a long time in free motion; where a heavy vertical shaft runs in a socket it is preferable to all or any other articles. This oil rises in greater or less abundance in most of the salt wells of the Kanawha, and, collecting where it rises, is removed from time to time with a ladle."

He refers to one well in particular, dug in 1814 to a depth of 475 feet. This was a flowing well, discharging "periodically at intervals of from two to four days, and from three to six hours duration at each period," 30 to 60 gallons at each irruption. When the oil flowed, great quantities of natural gas were also discharged.

This review would hardly be complete without some reference to the well near Burkesville, Ky., bored in 1829. Mr. Peckham quotes from Niles' *Register* :—

"Some months since, in the act of boring for salt water on the land of Mr. Lemuel Stockton, situated in the county of Cumberland, Kentucky, a run of pure oil was struck, from which it is almost incredible what quantities of the substance issued. The discharges were by floods, at intervals of from two to five minutes, at each flow vomiting forth many barrels of pure oil. I witnessed myself, on a shaft that stood upright by the aperture in the rock from which it issued, marks of oil 25 or 30 feet perpendicularly above the rock. These floods continued for three or four weeks, when they subsided to a constant stream, affording many thousand gallons per day. This well is between a quarter and a half mile from the bank of the Cumberland river, on a small rill (creek) down which it runs to the Cumberland river. It was traced as far down the Cumberland as Gallatin, in Sumner county, Tennessee, nearly 100 miles. For many miles it covered the whole surface of the river, and its marks are now found on the rocks on each bank.

"About two miles below the point on which it touched the river, it was set on fire by a boy, and the effect was grand beyond description. An old gentleman who witnessed it says he has seen several cities on fire, but that he never beheld anything like the flames which rose from the bosom of the Cumberland to touch the very clouds."

We will close this outline of the earlier production of American petroleum by an extract from an article written by Professor Benjamin Silliman, the elder, for the *American Journal of Science and Arts* in 1833, descriptive of the oil springs of the Seneca Indians, near Cuba, N. Y.:—

"This is situated in the western part of the county of Allegheny, in the state of New York. This county is the third from Lake Erie on the south line of the state, the counties of Cattaraugus and Chautauqua lying west and forming the southwestern termination of the State of New York. The spring is very near the line which divides Allegheny

and Cattaraugus.* * * The country is rather mountainous, but the road running between the ridges is very good and leads through a cultivated region rich in soil and picturesque in scenery. Its geographical formation is the same with that which is known to prevail in the western region; a silicious sandstone with shale, and in some places limestone, is the immediate basis of the country. The sandstone and shale (the limestone I did not see) lie in nearly horizontal strata. The sandstone is usually of a light gray color, and both it and the shale abound with entrocites, encrinites, coralines, terebratula, and other *reliquiæ* characteristic of the secondary transition formation. The oil spring or fountain rises in the midst of a marshy ground. It is a muddy, dirty pool of about eighteen feet in diameter and is nearly circular in form. There is no outlet above ground, no stream flowing from it, and it is, of course, a stagnant water, with no other circulation than that which springs from the changes in temperature and from the gas and petroleum that are constantly rising through the pool.

"We are told that the odor of petroleum is perceived at a distance in approaching the spring. This may not improbably be true in particular states of the wind, but we did not distinguish any peculiar smell until we arrived on the edge of the fountain. Here its peculiar character became very obvious. The water is covered with a thin layer of petroleum or mineral oil, giving it a foul appearance as if coated with dirty molasses, having a yellowish brown color.

"They collect the petroleum by skimming it like cream from a milk pan. For this purpose they use a broad flat board made thin at one edge like a knife, it is moved flat upon and just under the surface of the water and is soon covered by a coating of petroleum, which is so thick and adhesive that it does not fall off, but is removed by scraping the instrument upon the lip of a cup. It has then a very foul appearance, like very dirty tar or molasses, but it is purified by heating and straining it while hot through flannel or other woolen stuff. It is used by the people of the vicinity for sprains and rheumatism, and for sores on their horses.

"It is not monopolized by any one, but is carried away freely by all who care to collect it, and for this purpose the spring is frequently visited. I could not ascertain how much is annually obtained, the quantity must be considerable. It is said to rise more abundantly in hot weather than in cold.

"I cannot learn that any considerable part of the large quantities of petroleum used in the Eastern States under the name of 'Seneca Oil' comes from the spring now described. I am assured that its source is about one hundred miles from Pittsburg, on Oil creek, which empties into the Allegheny river in the township and county of Venango. It exists there in great abundance and rises in purity to the surface of the water. By dams, inclosing certain parts of the river or creek, it is prevented from flowing away and it is absorbed by the blankets, from which it is wrung * * * And as there are numerous springs of this mineral oil in various regions of the west and south connected especially with the saline and bituminous coal formations, it would promote the cause of science if notices of any of them were forwarded for publication.

"The petroleum sold under the name of 'Seneca Oil' is of a dark color, between that of tar and molasses, and its degree of consistency is not dissimilar, according to temperature. Its odor is strong and too well

known to need description. I have frequently distilled it in a glass retort, and the naptha which collects in the receiver is of a light straw color and much lighter, more odorous and inflammable than petroleum. In the first distillation a little water usually rests in the receiver at the bottom of the naptha. From this it is easily decanted, and a second distillation prepares it perfectly for preserving potassium and sodium, the object which led me to distil it, and these metals I have kept under it, as others have done, for years. Eventually they acquire some oxygen from or through the naptha, and the exterior portion of the metal returns slowly to the condition of alkali, more rapidly if the stopper is not tight. The petroleum remaining from distillation is thick like pitch. If the distillation has been pushed far the residum will flow only languidly into the retort, and in cold weather it becomes a soft solid resembling mineral pitch."

DRAKE'S WELL.—The historic moment for petroleum was that at which Drake "struck oil" on Watson's flats, near Titusville, August 28, 1858. It was an event so momentous to the future of the grand industry it started that this report would be far from complete if it did not devote considerable space to the story. As might be expected, every writer on petroleum makes some reference to this well, but we are particularly indebted for what follows to the graphic description of Henry in his *Early and Later History of Petroleum*, to Crew in his *Practical Treatise on Petroleum*, and to Peckham's most comprehensive report for the Tenth United States Census. The accuracy of the statements have been verified, and many new facts added to the exhaustive records, by personal interviews on the part of the writer with the practical men who have been familiar with the petroleum industry from its inception, and with old residents of Titusville and the vicinity who could recall the events of thirty years ago with great exactness.

The first oil company organized in the United States was the Pennsylvania Rock Oil Company, with a nominal capital of $500,000, which filed its certificate of incorporation, according to law, in the clerk's office at Albany, New York, December 30, 1854. The projectors were George H. Bissell and Jonathan D. Eveleth, members of a law firm in New York city. It chanced that Mr. Bissell's attention had been directed to petroleum by noticing a sample of it when on a visit to Hanover, N. H., his native place. This sample had been brought to Professor Crosby, of Dartmouth College, by Dr. T. B. Brewer, the son of one of the members of the firm of Brewer & Watson, lumber merchants of Titusville. Mr. Bissell's interest found substantial expression in the purchase of one hundred and five acres of the "Watson's flats" near Titusville, including an island at the junction of Oil and Pine creeks. It was on this island that oil had been collected for eight or nine years by means of a series of pits, arranged like separators, the water flowing away below leaving the oil floating on the surface to be dipped up with blankets. Some of the organizers of the company resided at New Haven, Conn., and, at their suggestion, a quantity of the oil was sent Prof. Benjamin

Silliman, Jr., who made an exhaustive analysis and an elaborate report. As the result of this examination, which was most favorable, a "Pennsylvania Rock Oil Company" was formed in Connecticut, with New Haven as its headquarters, and the property held by the New York corporation transferred to it.

This brings us to 1857. During the three or four years intervening the territory had been worked for oil with indifferent success, by means of trenches and shallow wells. Mr. Bissell still retained his interest in the Connecticut company. He happened, in 1856, to see an advertisement of "Kier's Petroleum." This was a patent medicine owned by Samuel M. Kier, a druggist of Pittsburg. His advertisement showed the derrick of the brine well from which the oil was secured with the brine. It suggested to Mr. Bissell that perhaps the crude, which was being obtained in such limited quantities by means of the surface pits and trenches at Titusville, might be found in paying quantities if artesian wells were sunk. The Seneca Oil Company succeeded the Pennsylvania Rock Oil Company of Connecticut in 1857, with the plan of seeking for the oil by drilling. E. L. Drake, who soon became known as "Colonel" Drake, was sent to Titusville the following year to carry out this project. It took a month to secure necessary tools and men sufficiently skilled to sink the well. Besides, the hole he tried to dig down to the rock at which to begin drilling filled with water and quicksand and forced him to invent some new way of reaching that point. It occurred to him to drive a pipe through the sand and clay, a plan afterwards generally adopted, not only in oil well boring but in all artesian drilling. Mr. Drake was the first to try this method, putting down a tube thirty-six feet where it struck the rock. Drilling then commenced and proceeded slowly under the direction of "Uncle Billy" Smith and his two sons, until the bore had penetrated the rock thirty-three feet, when, on Saturday night, August 27, the drill dropped into a crevice about six inches. The tools were pulled out and put aside for the work to be resumed on Monday. But, Sunday afternoon, Smith visited the well to make sure that all was safe, and, on looking down the pipe, saw liquid within a few feet of the top. He dipped up a little and found it to be oil. They had reached petroleum in the first sand, at a depth of thirty-three feet through the rock and sixty-nine and one-half feet below the surface of the ground. When the pump was started on Monday the well produced at the rate of twenty-five barrels per day, at that time an incredible quantity. They had hoped for gallons and found barrels of the precious fluid.

Development Since 1859.—The success of Drake's well ushered in a period of almost unparalleled excitement, surpassed only be the gold fever of California ten years before. Mr. Bissell was notified by telegraph that oil had been found, and quietly bought up most of the stock of the Connecticut corporation before the news was generally known. The value

of the product had already been established by the tests of Professor Silliman and others, and the possibility of making burning oil from it had been demonstrated at a number of refineries. The need of an illuminant had long been felt—the decadence of the whale oil industry, through the extermination of the whales, having forced the production of illuminating oil by the destructive distillation of coal imported from England and Nova Scotia; but the kerosene so made was very far from satisfactory, on account of its pungent odor and tendency to smoke when burning. However, several large works in the vicinity of New York city had been built at great cost, and had opened the way for the oil industry of to-day. Western Pennsylvania, in 1859 and the next few years, was the scene of indescribable activity and speculation. Wells were sunk, in great numbers, along Oil creek, French creek and the Allegheny river. Adventurers flocked thither from all parts of the country What was soon known as the "oil region," was transformed from an almost unbroken forest into camps and towns.

Many of the wells yielded nothing, others lasted but a short time, while some gave enormous quantities of oil. As the producing fields changed, the population shifted with the fields, and the towns that had sprung from the wilderness as by the touch of a magician's wand, vanquished almost as quickly as they had grown. Pithole City, for example, in 1865 next to Philadelphia the largest post office in the state, has now entirely disappeared and the site of the city become a farm. Crew describes this period in his *Practical Treatise on Petroleum*, very graphically:—

"At or about this time a visit to this wild section of western Pennsylvania was full of interest, and to any one who could cheerfully put up with the rude accommodations the place offered, and with the still ruder manners of the wild adventurers who thronged there from every point of the compass, the trip was one replete with a kind of romantic enjoyment, novel and strange. For miles around in every direction the tourist was never out of sight of the derrick, the puffing engine, the huge piles of barrels and the enormous iron tanks filled with oil. Temporary tramways were stretched in every direction to facilitate the movements of the oil. Immense teams of mules or horses were employed in the transportation of the oil from the wells, either to the nearest railroad station or to the flat boats on Oil creek. The surface of the whole country was saturated with oil from the leakage of the barrels, the overflow and enormous wastage from the wells before they could be got under control, and from the leakage and bursting of tanks. The peculiar odor of petroleum prevaded everything; the air for miles was thoroughly saturated with it; nothing else was thought of; nothing else was talked about. Land was sold at thousands of dollars per acre. Fortunes were, literally and without exaggeration, made and lost in a day. Oil companies with high-sounding names were organized almost without number, absorbing millions of money; many companies were formed without the shadow of basis for operations; and hundreds who were as covetous as they were ignorant were drawn in the maelstrom of speculative excitement and hopelessly ruined."

We give elsewhere a table showing the quantities of oil produced each year. From this it will be seen that, by the end of 1859, fully 200 wells were in successful operation and the production of crude oil amounted to 2,000 barrels. Phenominal growth then followed. Next year the production was 500,000 barrels, and in 1861 it had increased to 2,113,609 barrels. In addition to this amount, it is estimated that at least 10,000,000 barrels ran to waste because of lack of barrels to hold it or a market to take care of it. Peckham speaks briefly of the territory developed:—

"The territory over which operations were conducted was for a long time confined to the valleys of the Allegheny river and its tributaries, on the supposition that the present configuration of surface was related to the strata containing the oil. For this reason wells were drilled in the valley of Oil creek from Titusville to Oil City; on French creek, from Union City to Meadville and Franklin; and, on the Allegheny, at Tidioute. Although the coal oil manufactories all over the country, with scarcely an exception, commenced to work petroleum instead of coal, the production was so enormous, as compared with the demand, that the market was soon glutted and the price fell to almost nothing."

Henry, in *The Early and Later History of Petroleum*, describes the increase of production as follows:—

"The total daily product of all the wells in June, 1860, was estimated at 200 barrels. By September, 1861, the daily production had reached 700 barrels; and then commenced the flowing-well period, with an addition to the production of 6,000 or 7,000 barrels a day. The price fell to 20 cents a barrel, then to 15, and then to 10. Soon it was impossible to obtain barrels on any terms, for all the coopers in the surrounding country could not make them as fast as the Empire well could fill them. Small producing wells were forced to cease operations, and scores of operators became disheartened and abandoned their wells. The production during the early part of 1863 was scarcely half that of the beginning of 1862, and that of 1864 was still less. In May, 1865, the production had declined to less than 4,000 barrels per day.

"Commencing at Titusville in 1859, the tide of development swept over the valley of Oil creek and along the Allegheny river above and below Oil City for a considerable distance; then Cherry run, in 1864. Then came Pithole creek, Benninghoff and Pioneer run; the Woods and Stevenson farms, on Oil creek, in like succession, in 1865 and 1866; Tidioute and Triumph hill in 1867, and in the latter part of the same year came Shamburg. In 1868, the Pleasantville oil field furnished the chief center of excitement."

Space cannot be spared to follow the development of the different oil fields further than to make very general mention of each of them as they have in turn appeared. During the first two years, after the success of Drake, the search for oil was restricted to the territory around Titusville, wells being sunk up and down both sides of Oil creek and back on the hills that form its banks. The drills were then tried on the Allegheny river, and its shores were found to yield abundantly. It was not unnatural, though not very logical, for the petroleum seekers to feel that there must be some connection between the trend of Oil

creek and the Allegheny river and the underground deposits of oil. As it happened, the oil-bearing strata extended generally under these two streams, but a glance to-day at a map showing the location of all the oil fields that have been discovered will demonstrate to the eye the fallacy of this belief, as the fields in some instances stretch across the Allegheny river at right angles.

Up to this time all of the oil secured had been lifted from the wells by pumps. A new surprise was now in store for the producers. The first flowing well was struck in February, 1861, on the McElhenny farm, yielding 300 barrels per day. It flowed for fifteen months. This surprise had not spent itself, when the Phillips well was struck, shooting forth ten times as much oil per day as the first well, and was followed soon by the Funk well matching the Phillips in productiveness, giving 3,000 barrels per day; the Noble well, with 3,000 barrels per day; and the Sherman well, with 2,000 barrels per day. Crew is authority for the statement that the Noble well produced upwards of $3,000,000 worth of oil, and that the Sherman well flowed an average of 900 barrels per day for two years.

Such a stimulus as the finding of these gushers, or petroleum fountains, following one another in quick succession, increased the production enormously; for not only did the large wells add to the quantity produced, but the success in striking them encouraged prospectors generally to renewed efforts for obtaining capital for further developments. The production in 1861—a little more than 2,000,000 barrels—was increased fifty per cent. in 1862, to 3,000,000. As a natural consequence, prices rapidly declined. Henry, in the quotation already given, speaks of ten cents per parrel as the lowest limit; but we believe five cents per barrel was the price actually touched in November, 1861.

A fresh surprise was still in store for the oil operators; when it was found that productive territory need not necessarily underlie the valleys and river bottoms, but that the high lands also covered the hidden treasure. In 1862, the drillers became crowded in following the banks of the Allegheny river, and pushed back into the adajcent country. They had already climbed the hills bordering Oil creek and the Allegheny river, but now tested the high plateaus of Clarion, Butler, Armstrong, McKean and Warren counties. In 1864, the Economy well and the surrounding region in Warren county, and the Pithole division in Venango county became prominent.

The Venango oils had been dark green to black; the new wells gave a beautiful amber colored product. The Pithole division reached its maximum productiveness in 1866. The Allegheny field of dark green, almost black, and heavy gravity, oil appeared in 1867. The Tidioute and Armstrong fields was found in 1868. In this same year the production about Parker in Clarion county also became known. The Butler-Clarion belt was discovered in 1870. This opened up what was afterwards known as

the Lower or Southern field, oils of lighter color and higher gravity; a territory of remarkable richness, that has continued even to to-day, standing second only to the great Bradford district in quantity of oil produced. The wells are from 900 to 1,300 feet deep, and the oils of a reddish amber color.

Much of this extension of the oil region was carried out on lines developed by C. D. Angell and others, who formulated "belt theories" which they thought would enable them to successfully locate the subterranean deposits. Angell made a study of the relative location of the largest wells. In the Titusville group a narrow strip of country running in a direction a little east of north, took in all the most productive ones. It is strange that the fact had not been noticed before. When the lower country was discovered, he quietly mapped out a similar field in Clarion and Butler counties, parallel to the Titusville one, and secretly secured leases of much of the territory. His success was patent, and others were led to see that he worked with method which they soon copied. The plan was somewhat more scientific than that which had been followed in developing the territory along Oil creek and the Allegheny river; and yet wildly tracing a line by the direction of a compass and hoping to find productive territory after passing miles of untested country, is almost superstitious. Even if the trend of the oil-bearing strata has been found, and there is reason to believe that the same strata extend under untried territory; still, when we remember that the slightest variation from the true angle at the start soon becomes an error of miles when carried to a distance, we see the futility of the plan. Besides, nature's lines are seldom straight. The oil-bearing sands are undoubtedly deposited in curves and in beds at intervals only. This is now recognized, and the oil leads are traced by means of the drill, without any reference to the topographical conformation of the surface.

A Northern district next claimed from the Middle and Southern a share of public attention, when the Bradford field was found. The date generally given is that of December 6, 1874, when a well on the Buchanan farm, two and one-half miles from the town of Bradford, was struck by Butts & Foster. But as early as 1862, the Barnesdall well had been put down to a depth of 200 feet and abandoned because no oil was found. Three years later, F. E. Dean went down 900 feet and gave up the search. In 1866, a number of persons joined in sinking the Barnsdall well to 875 feet, and having gone considerably below the level of oil in Venango county, the work was stopped. James E. Butts first reached the Bradford stratum of producing sand, going down 1,110 feet in 1871; but, as only ten barrels per day was secured, it was thought oil in paying quantities could not be obtained. The well on the Buchanan farm, finished in 1874, yielded 70 barrels per day. In 1875, the production was fully 25,000 barrels; in 1876, it had increased to 380,000 barrels; in 1877, to 1,450,000 barrels; in 1878, to 6,500,000 barrels—

as much in a day as was produced in a whole year in 1875. In the following year the production was again doubled, and brought up to 14,200,000 barrels. In 1880, it was 22,300,000 barrels; in 1881, over 23,000,000 barrels. The production of all the other Pennsylvania fields in that year was only 4,238,000 barrels, the Bradford production being six-sevenths of the whole. The surprising feature of this yield was not the size of the wells, for they did not average one-tenth that of the Venango county wells, but the uniformity and steadiness with which they offered their treasure. Peckham, giving Dr. Ashburner as his authority, states that up to 1880, out of 6,249 wells drilled in the Bradford territory, only 3.77 per cent. proved dry holes; while one-fourth of the wells put down in the Venango sands, from their discovery in 1859 to 1880, yielded nothing. The Bradford wells are very deep, some going down more than 2,000 feet. The oil is dark in color and quite heavy in gravity.

It was in connection with this field that the producing territory was found to stretch over into Cattaraugus county, New York; but, as stated elsewhere, it has not been practicable to distinguish between the oils obtained in New York and Pennsylvania. In 1889 and 1890, careful estimates were made of the proportion of the Bradford field production secured in New York, and it was found to be about 26½ per cent. of the total. This then included the Allegany and Richburg production; which, in fact, largely exceeded the regular Bradford production in New York, 18 per cent. out of the 26½ per cent. having been Allegany oil.

In 1875, the Bullion and Warren oils appeared. In 1876, the Beaver district of Clarion county became prominent. In June, 1879, oil was found in the Richburg field in Allegany county, New York; closely allied, so far at least as location is concerned, with the Bradford territory. The first well was put down as a "wild cat" or test well, and produced at the rate of four barrels per day, hardly foreshadowing the enormous output soon to follow; for, in 1881, it had reached 600,000 barrels; and, in 1882, 6,450,000 barrels.

In 1880, the Clarion and Warren productions became a feature in the calculations of the producers. They yielded beautiful amber oil, as light as 48° gravity. They were both the result of "wild cat" ventures. A "wild cat" well is one that is put down to test new territory, regardless of supposed geological connection with known territory. In May, 1882, the Cherry Grove oil made its appearance of sudden growth and of almost as sudden decline. Found in May, it yielded in July over 24,000 barrels per day; but, in October, less than 9,000; the average, for 1883, being only 2,000 barrels per day, which fell to 400 the following year.

In September, 1884, the Thorn creek oil was secured; the great Phillips well, the largest flowing well ever opened in America, starting at the rate of 10,000 barrels per day, which gradually declined to 500 barrels. Crew publishes in his work on petroleum a letter about this well

from F. H. Taylor of Oil City, editor of the *Derrick Hand-Book of Petroleum.* The letter was written only three months after the well was struck, and can, therefore, be accepted as accurate:—

"This well was drilled through the sand October 25 and 27, 1884, and being filled with salt water, it made no show of oil. It was 'shot' October 27. The owners were not expecting a large well, and consequently were not prepared for it. The result of the torpedo was that the well began flowing at a rate estimated from 400 to 500 barrels per hour. All this oil flowed on the ground for six hours, so that it is impossible to more than estimate its production for that time; but I think it safe to say that in some one hour of that time it made 500 barrels, or, at that rate, 12,000 barrels a day. About dark they got part of the oil turned into a tank; and, with a gauge, and an estimate of what was being lost, made its production at that time 130 barrels an hour. We generally call its first day's production 7,500 barrels, because that was all that was saved from it; but its actual output was undoubtedly 9,000 to 10,000 barrels and may have been more."

In 1885 and 1886, the production in Washington and Greene counties became prominent. During these two years the number of wells put down was greatly increased; the total for 1886 being 3,478, the largest number for several years. The stocks of crude continued to be so large as to occasion general alarm among producers. The largest stock on record is that of August 31, 1884, a total of 39,084,561 barrels. The average stock of 1884 was 35,953,975 barrels; of 1885, 37,698,481 barrels; of 1886, 35,732,291 barrels. The early part of 1887 showed little decrease in production; and prices, with some minor fluctuations, steadily declined. In August, 1885, crude was quoted at $1.04 per barrel; in January, 1886, it had declined to 90 cents. It averaged for December, 1886, only 71 cents; having several times during the year fallen below 65 cents. The bottom price of $54\frac{3}{8}$ cents was touched in July, 1887; the average for the month being only $59\frac{1}{4}$ cents. A plan was formulated at this time by the producers looking to curtailing for a time the output of the oil fields. An agreement was drawn up and signed by the members of the Petroleum Producers' Association beginning: "Whereas there has accumulated the past ten years an excessive stock of crude petroleum, which is deteriorating in quality, and a portion of which each year becomes sediment, valueless for any purposes, and the carrying of which excessive stock requires the expenditure of vast sums annually; and whereas, in consequence of the existence of such stock, the price of crude petroleum has, for the past year, been largely below the cost at which the same was produced, etc." By this agreement, about one-quarter of the production, or at least 17,500 barrels per day, and as much more as possible, was to be "shut in" for one year, beginning November 1, 1887. The movement was a success. The average daily production of the three months ending October 31, was about 64,000 barrels; that for the following three months only 41,000 barrels, a reduction of 23,000 barrels per day. The agreement was to stop cleaning out

and torpedoing all wells for one year and to shut in a certain part of the production of the other wells. In 1888, the production was only 16,488,668 barrels; while it had been, in 1887, 22,356,193 barrels. The stock reported for October 31, 1887, of 30,662,583 barrels was reduced to 18,995,814 barrels by December 31, 1888; and the average price of certificates advanced from about 67 cents in September, 1887, to 93 cents in September, 1888; the average for the year 1888 being 87 cents, as compared with 66⅝ cents for the year 1887.

In 1889, production was again resumed and 5,435 wells were completed, as compared with only 1,515 in 1888, and 1,660 in 1887. In January, 1888, there were but 64 wells going down; while in January, 1889, there were 341. The average for 1889 was 548 wells, as compared with that for 1888 of 136. The year 1890 shows the largest number of wells ever completed in any one year, a total of 6,358.

The phenomenal McDonald field appeared in 1891. Scarcely one-half the number of wells was completed this year as in the year before; yet the production and stocks increased over 5,000,000 barrels, because of the extraordinary average production of the wells. The average for the year was 58.90 barrels, while during October it reached 201.54 barrels. In consequence of this great increase in production the premium which had been paid on much of the crude produced, making its price from 20 to 25 cents above the certificate quotation, was removed. The McDonald field began to decline in the latter part of 1891 and continued to decline through 1892. In that year the production of the Sistersville field took its place to a considerable extent, but the low prices prevailing have not encouraged the search for new fields.

MINING OF CRUDE PETROLEUM.

Classification of Producing Territory—Origin of Petroleum—Oil Wells and Tools—Cost of Wells—Torpedoes—Flooding.

When Prof. S. F. Peckham published his report for the Tenth United States Census, he classified the production up to December 31, 1880, under ten divisions or districts:

	Barrels.
Oil Creek division, including Shamburg, Pleasantville and Enterprise,	35, 517, 217
Pithole district, including Holderman, Morey and Ball farms,	4, 816, 298
Central Allegheny division, including Scrubgrass to West Hickory,	6, 482, 900
Lower Allegheny division, including Butler and Armstrong counties,	37, 342, 978
Tidioute district, including Economites, Henderson farm, etc.,	4, 674, 345
Clarion district, including Clarion county,	20, 381, 638
Bradford district, including McKean and Elk counties; also Cattaraugus and Allegany counties, New York,	44, 574, 921
Bullion district, including Venango county,	2, 312, 190
Warren division, including Stoneham, Clarendon, etc.,	448, 213
Beaver division, including Smith's Ferry, etc.,	339, 631
Total production from all districts,	156, 890, 331

His recapitulation above covers the entire production of crude petroleum from the discovery of Drake's well to January 1, 1881. It is interesting to look at the changes in the quantities produced in each field each year. We, therefore, give elsewhere his figures in detail. (See page 86.)

Six years later, the Second Geological Survey of Pennsylvania (1886) brings the production down to January, 1883. A comparison of the distribution given in that report with that of the Tenth United States Census shows that while the figures of total production vary but slightly, the distribution among the several fields is somewhat different. The Central Allegheny division is now called the Butler and Armstrong division, and a new field has been added in the Allegany county division, New York

	Barrels.
Oil Creek division,	33, 262, 000
Central Allegheny division,	7, 260, 000
Tidioute and Fagundus division,	9, 860, 000
Beaver and Smith's Ferry division,	904, 000
Pithole and Cashup division,	3, 378, 000
Butler and Armstrong division,	39, 934, 000
Clarion division,	21, 827, 000
Bradford division,	85, 866, 000
Warren and Forest division,	4, 196, 000
Bullion division,	2, 541, 000
Allegany county division, New York,	7, 055, 000
Total barrels of 42 gallons,	216, 083, 000

We give this table also elsewhere in detail. (See page 87.)

The United States Geological Survey for 1888, gives the production for that year by districts as follows:

	Barrels.
Bradford and Allegany,	6, 284, 375
Forest,	204, 250
Warren,	1, 865, 366
Butler,	3, 478, 387
Bald Ridge,	1, 220, 054
Tidioute,	660, 328
Washington,	2, 322, 190
Greene,	9, 528
Mt. Morris,	79, 279
Nineveh,	4, 227
Shannopin,	301, 906
Brush Creek,	54, 778
Total,	16, 484, 668

The United States Geological Survey for 1890, classifies the production for that year according to fields as follows:

	Barrels.
Bradford district, Pennsylvania and New York; and Allegany county, New York,	7, 158, 363
Forest county,	258, 955
Warren county,	2, 347, 434
Butler and Clarion counties, etc.,	5, 358, 403
Tidioute and Titusville,	885, 119
Allegheny county,	541, 092
Beaver county,	602, 736
Washington county,	3, 848, 145

BRADFORD OIL FIELD.

	Barrels.
Greene county,	392, 912
Franklin district,	65, 276
Smith's Ferry district,	29, 000
Pennsylvania and New York,	21, 487, 435

We have brought these statistics together here, somewhat out of their regular order, to show the difference in general classification employed at different times, owing largely to the shifting of the producing fields.

At one time an effort was made to classify oils according to the sands from which they came; namely, first sand, second sand, and third sand, crude—meaning by this nomenclature the geological rock stratum from which the oil was drawn. This plan was soon found to be impracticable. Not only was it difficult to determine from which sand different wells were obtaining their supply, owing to the lack of intelligence and care on the part of those sinking them, but other sands than those thus numbered in the early days of well-boring, appeared in the later borings. It soon became clear that geographical distribution was more satisfactory than geological.

The late Dr. Charles A. Ashburner, geologist in charge of the Pennsylvania Survey of 1884, classified all the producing wells of that year under four general heads: Northern, Middle, Southern and Miscellaneous fields.

The common classification of to-day recognizes, likewise, four general divisions: Bradford, Middle, Lower, and Washington or Southwestern districts.

1. *Bradford*—The main field lies in the northern part of McKean county, but extends several miles into Cattaraugus county, of New York State. It also includes the large field of Allegany or Richburg oil lying wholly in Allegany county, New York; and the Carrollton production of Cattaraugus county, New York. These are detached basins of oil rock, separated by several miles from the main producing territory; the former to the northeast, and the latter to the northwest, of it. The large wells of the Kinzua district, lying southwest of the main field, and the small wells of the Windfall Run district, lying to the west of the main field, both in McKean county, are classed with Bradford. The oil of this field is dark amber green to black, and of heavier gravity than that of the other fields.

2. *Middle.*—This includes particularly the production of Warren and Forest counties, with the exception of a few pools in the southwestern corner of the former and the western end of the latter. The Stoneham, Cherry Grove, Clarendon, Tiona, Kane, Grand Valley, Balltown and Cooper oils belong to this division. The crude is generally of an amber shade, but varies greatly in different parts of the field both in color and gravity.

3. *Lower.*—This includes all the production of Venango, Clarion, Butler, Beaver and Lawrence counties It is a field of great extent and embraces a great variety of oils, from the heavy dark oils of the Franklin and Smith's Ferry districts to the high gravity, lighter-colored oils of the Parker district. The oils are green to black in color and of light gravity.

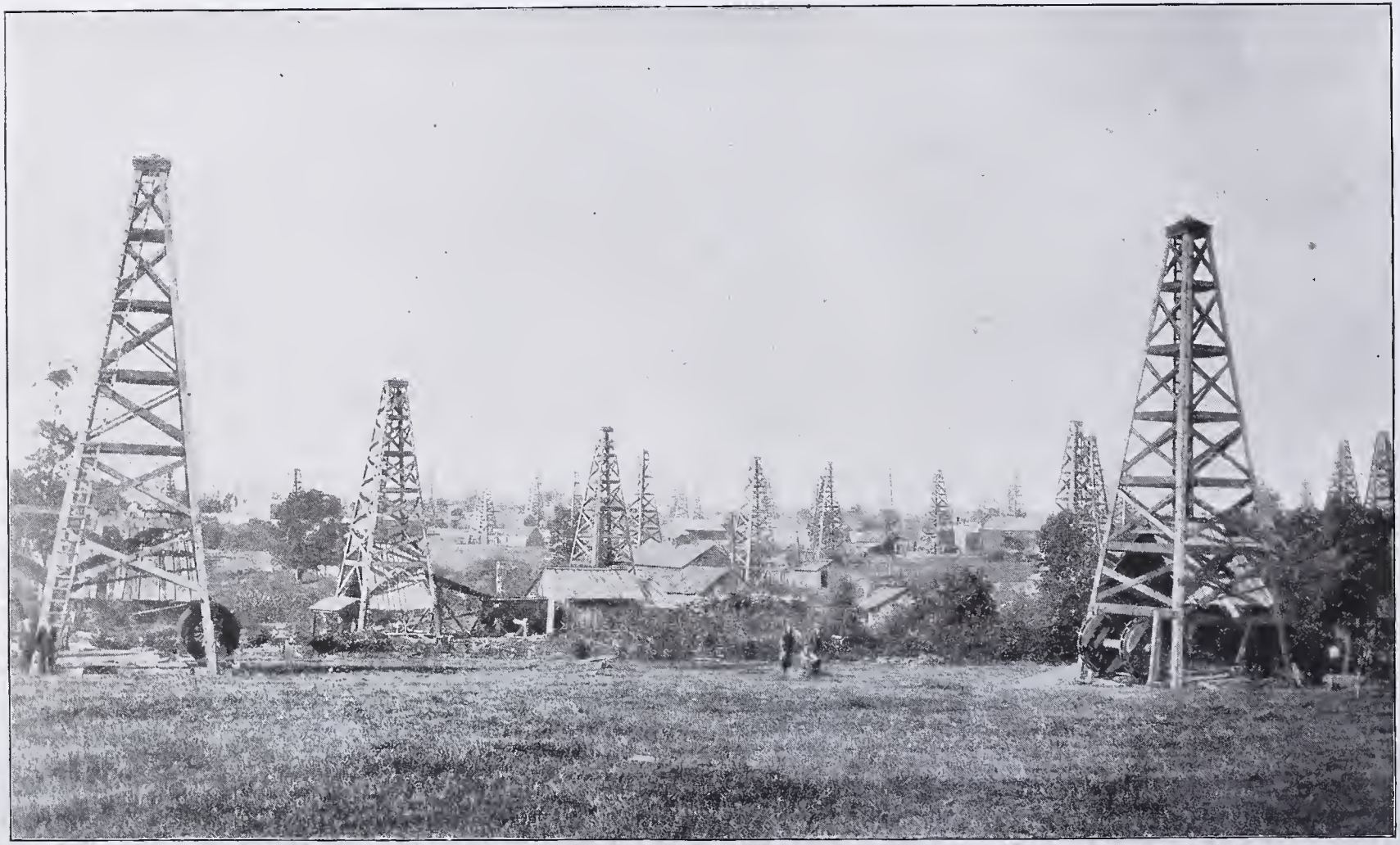
4. *Washington or Southwestern*—This includes the production of southwestern Pennsylvania, particularly in Allegheny, Washington and Greene counties; the Turkey Foot and other oils of West Virginia, and the Macksburg production of southwestern Ohio, are also included in this general field in statistics prepared to show the total production of what is termed Pennsylvania crude, in distinction from the sulphur-charged crudes of Ohio. The oils are a reddish amber in color and of light gravity.

A brief reference should here be made to the geological location of petroleum in Pennsylvania. Prof. S. F. Peckham, after a careful compilation of most of the data on the subject in existing literature up to 1880, summarizes the results:—

"According to the latest published researches, I conclude that the geological formations in western Pennsylvania, from which petroleum has been obtained, belong to the Chemung and, perhaps, later groups of the Upper Devonian, and consist of shales and marls interstratified with sandstones. The sandstone varies in character from a coarse-grained uncemented sandstone to a pebble conglomerate, composed of worn pebbles of white or slightly colored opaque quartz overlaid by marls and slates, often highly silicated, forming very hard and impervious crusts. This pebble conglomerate consists of two varieties, occupying separate horizons, in one of which the pebbles are nearly spherical and in the other flattened. Between these beds of sandstone or conglomerate that contain the oil are beds of shale, often of great thickness, with which are thin beds of sand and shells . . . . . The sandstones and conglomerates are of quite uniform structure over wide areas; for instance, the Venango third sand consists of smooth, rounded pebbles, while the Bradford third sand is a porous sand stone."

His final conclusion is that Pennsylvania crude "occurs, saturating the porous portions of formations that lie far beneath the influence of the superficial erosion, like sandbars in a flowing stream or detritus on a beach. Their formations or deposits, taken as whole members of the geological series, lie conformably with the enclosing rocks and slope gently toward the southwest. The Bradford field in particular resembles a sheet of coarse-grained sandstone, 100 square miles in extent by from twenty to eighty feet deep, lying with its southwestern edge deepest and submerged in salt water, and its northeastern edge highest and filled with gas under an extremely high pressure.

"It is further to be concluded that, from whatever source the petroleum may have originally issued, it now saturates porous strata, not of any particular geological age, but runs through a vast accumulation of sediments from the oldest to the newest rocks in Pennsylvania and West Virginia, embracing all the rocks between the Lower Devonian and the Upper Carboniferous."



VENANGO OIL FIELD.

The most exhaustive and probably most valuable treatise on the geology of Pennsylvania petroleum is the admirable report of John F. Carll, to the geologist in charge of the Second Geological Survey of Pennsylvania, published in 1880. He describes the difficulties under which a geologist works when attempting a study of the subject:—

"In the first oil development by artesian wells, nothing was known about the sands. Wells were drilled until indications of oil appeared, without regard to the character of the strata pierced. But experience soon proved the sand rock to be its source, and then commenced deeper drilling for other sands, which, in the valley of Oil creek, resulted in the discovery and classification of three sands, these being all the oil bearing sands found in that locality, even after several wells had been sunk much deeper in quest of others.

"In the progress of development, locations for wells were selected on higher ground. The drill passed now through four or five other and higher definite sand rocks before reaching the geological horizon of the first sand of Oil creek, and when this fact was made clear, it became customary among drillers to throw out these upper sands from their well records. They were called the mountain sands, and were also numbered 1, 2, 3, etc. The drillers commenced their count of the oil rocks with that one which they found at the depth at which they supposed the first sand of Oil creek to lie; but in so doing, many errors occurred, resulting from a want of accurate observation, first, as to the surface elevation of the wells drilled on high ground, and second, as to the dip of the oil-bearing strata, which materially affected the comparison of elevations, even when these were accurately known. A third source of error may be found in the fact that a thick stratum of sand lying single and solid in one place, is often split into two, or, in other words, is represented by an equivalent of two sands with shales intervening in another place, perhaps only a short distance from the first."

He speaks specifically of the three sands in which crude petroleum is found:—

"A comparison of records of wells on Oil creek, where the three leading sands of the petroleum measures lie with considerable regularity, both as to their thickness and the intervening distances between them, results in an average record about as follows: First sand, 40 feet thick; interval, 105 feet. Second sand, 25 feet thick; interval, 110 feet. Third sand, 35 feet thick. Total, 315 feet.

"In addition to these three regular sands, there is found in many of the wells a fine-grained, muddy, gray sand known among drillers as the 'stray third.' This lies from 15 to 20 feet above the regular third, and is from 12 to 25 feet thick. In some localities this rock assumes a pebbly character, and produces oil which is always darker than the third-sand oil, sometimes being nearly black.

"At different points on Oil creek, at Shamburg and other places, wells in close proximity to each other have been produced, some of them, black oil, some green, and some a mixture of both."

His careful study leads him to conclude that the whole oil field of western Pennsylvania, from Pittsburg to Lake Erie, constitutes a group of oil sands, above which lie 300 or 400 feet of soft formation everywhere, and below which there is another mass of soft shale. Between these two are to be found the oil sand deposits to 300 to 380 feet thick.

This he designates as the Venango group. It does not include the Warren or Bradford oil sands which are older and therefore deeper.

Dr. Charles A. Ashburner, in his *Geology of McKean County*, gives an excellent comparison of the oil sands of the different fields:—

"The Bradford sand consists of a gray and a white sand of about the same coarseness as the ordinary beach sand of the Jersey coast; compact yet loosely cemented. The average thickness of the sand is about 45 feet, and from top to bottom the sandy strata change but little in their general character. It is only when specimens from the successive layers are placed side by side and closely examined that any difference in structure can be recognized. The grains of sand are regular, vary but slightly in size, color and the quantity of cementing material which holds them together in their rock bed. The same homogeneousness which characterizes the vertical section is found to exist over a considerable horizontal area. In fact but little change is found to exist in the sand obtained from wells fifteen miles apart, or in the sand from intermediate wells . . . . The characteristics of the Venango sands are quite different . . . . . A productive Venango sand consists of a white, gray or yellow pebble rock, the pebbles being loosely cemented together and generally bedded in fine sand. The rock is open and porous. The interstices between the pebbles and the sand grains are extensive and capable of containing a large bulk of oil; but this character does not maintain itself over any extended area. Areas of such sand are small and scattered and are separated by sand beds, possessing a character belonging to the unproductive sands. The Venango sands are not homogeneous over any considerable area and are frequently very heterogeneous in section. The thickness of the sand varies; in one locality the upper part of the sand may be pebbly and of productive character and the lower part fine and contain no oil, while but a short distance away the conditions may be reversed."

He classifies the fields, and describes the sands and oils produced as follows:—

"NORTHERN OIL FIELD.

Black Sand.

Oil sand, fine grained, friable, very seldom containing pebbles as large as pin heads. Color, black, dark brown or chocolate brown; hence compared to coffee grounds; chocolate or ashes from red-ash coal.

Oil, dark amber, green, occasionally black. Gravity heavier than oil from Venango third sand.

MIDDLE OIL FIELD.

White and Gray Sands.

Oil sands irregular in their geological relations, as well as in composition and color; generally grayish and fine-grained, but sometimes white, coarse-grained and pebbly in streaks; oils, amber, ranging from dark amber to light amber, with considerable variation in gravity.

Southern Oil Field.

Venango Oil Sand Group.

White, grayish white and yellowish sand-stones, generally friable and coarse-grained, and frequently true conglomerates with water-worn quartz pebbles as large as hazelnuts. Oils, green, black, and in some cases amber. Gravity ranging from 30° to 51° B. Third sand oil 48° B.

Miscellaneous.

Oil from sand-stone above Venango group."

Carll's comparison is even more concise:—

"The 'Venango Third Sand' is a coarse pebble-rock associated with a clean white sand; the 'Warren Third Sand' is fine-grained, bluish-grey and somewhat muddy; the 'Bradford Third Sand' is of medium grain, friable, but sometimes almost floury, and of a decided brown or snuff color."

Origin of Petroleum.—The problem of the origin of petroleum is far from settlement. There is satisfaction, therefore, in noting such facts as are accepted without dispute. The sands in which oil is found are undoubtedly of sedimentary origin. They lie at the top of the Devonian system, having been deposited while the Devonian was merging into the Carboniferous. The composition of the sands varies so widely, from the coarsest pebbles down to the finest mud rock, all the intervening grades of conglomerates being found, that the manner of deposit, whether in river, lake or ocean, by river, shore or deep-sea currents, has not been determined. Carll eliminates the theory of river deposits and inclines to the belief that the sands are shore-line or sea-coast accumulations, wisely attempting no proof, and, like a true scientist, simply presenting the facts as he finds them.

Aside from the problem of the oil-bearing sand, we have the still more difficult one of the genesis of petroleum itself. Where and when was it formed? Is it indigenous to the rock in which it is found, or has it been condensed in those rock, having come up in the form of gas or vapor from deeper strata? In either case, is it the result of chemical reaction or of distillation by heat; and if so, is it the result of fractional or destructive distillation; and, finally, is the oil, however generated, of animal or vegetable origin, or of both? We can hardly hope to answer these queries, when the ablest scientists, after years of research and experiment, have left them unsolved.

The theory of the chemical origin of petroleum is, in many points, less in accord with observed facts than the other theories mentioned. It was first presented to the consideration of the scientific world by a French chemist, Berthelot, in 1866, and brought into prominent notice in 1877 by a paper read by Prof. Mendeljeff before the Chemical Society of St. Petersburgh. We quote from a resume of this paper as giving briefly the basis of the theory:—

"In speaking of the hypothesis of La Place upon the origin of the earth, in applying Dalton's law to the gaseous state in which all the elements constituting the terrestrial globe ought to be found, and taking into consideration their relative densities, M. Mendeljeff recognizes the necessity of admitting a condensation of metals at the center of the earth. Among these it is natural to presume that iron would predominate, because it is found in great abundance in the sun, in meteorites and basalts. Admitting further the existence of metallic carbides, it is easy to find an explanation, not only for the origin of petroleum, but also for the manner of its appearance in the places where the terrestrial strata, at the time of their elevation into mountain chains, ought to be filled with crevices to their center. These crevices have admitted water to the metallic carbides. The action of water upon the metallic carbides at an elevated temperature and under a high pressure has generated metallic oxides and saturated hydrocarbons, which, being transported by aqueous vapor, have reached those strata where they would easily condense and impregnate beds of sand-stone, which have the property of imbibing great quantities of mineral oil."

J. P. Lesley, in his letter transmitting the report of 1880 on the survey of the oil region, criticises this theory:—

"The chemical theory, so called, which looks upon petroleum as condensed from gas, the gas having been previously distilled from the great black shale formations (Marcellus and Genessee) must face the objections that such a process, if chemically possible, which is doubtful, ought to have distributed the oil everywhere and permanently blackened and turned into bituminous shales the entire thickness of this part of the earth crust for several thousand feet. It fails to explain the petroleum obtainable from the Cannel coals and from roof shales of bituminous coal beds. And it fails also to explain the entire absence of petroleum from immense areas of not only shales, but sand and gravel rocks, equally underlaid by the Marcellus and Genessee formations."

Prof. S. F. Peckham claims that there is overwhelming proof that the Pennsylvania oils are of vegetable origin:—

"Pennsylvania petroleum was examined in 1865 by Warren and Storer in this country, and in 1863 by Pelouze and Cahours in France, who found the lighter portion to consist of a certain series of hydrocarbons, identical with those obtained in the destructive distillation of coal, bituminous shales and wood, when the operation was conducted at low temperatures. * * *

"The section compiled by Mr. Carl shows the Devonian shales above the corniferous limestone and below the Bradford third oil-sand, to be 1,600 feet in thickness. This shale outcrops along Lake Erie, between Buffalo, New York, and Cleveland, Ohio. It is for the most part the surface rock in the neighborhood of Erie, Pennsylvania, and southward to Union City, and no one can examine it without noticing the immense quantity of fucoidal remains that it contains. Prof. N. S. Shaler discusses in much detail the extent and character of the Devonian black shale of Kentucky, and estimates it to cover 18,000 square miles at an average depth of 100 feet, and to yield on distillation fifteen per cent. of fluid distillate. It is not necessary to follow him in his calculations of the enormous bulk of this distillate as represented in barrels; the important point in this connection is that it is a very persistent formation, being revealed by borings over a very wide area, and doubtless extends

beyond the boundaries of Kentucky, eastward beneath the coal measures which contain the petroleum."

J. P. Lesley, in charge of the Second Geological Survey of the State, in his letter transmitting the report of the survey of the oil regions for 1880, inclines to the belief that primordial animals, as well as submarine plants, are the basis of petroleum:—

"The origin of petroleum is still an unsolved problem. That it is in some way connected with the vastly abundant accumulations of Palæozoic sea weeds, the marks of which are so infinitely numerous in the rocks, and with the infinitude of coralloid sea animals, the skeletons of which make up a large part of the limestone formations which lie several thousand feet beneath the Venango oil sand group, scarcely admits of dispute; but the exact process of its manufacture, of its transfer and of its storage in gravel beds is utterly unknown. That it ascended rather than descended into them seems indicated by the fact that the lowest sand holds oil when those above do not, and that upper sands hold oil where they extend beyond or overhang the lower."

This naturally leads to the inquiry; was this organic matter, be it animal or vegetable, deposited with the sand now holding the petroleum? In other words, is the oil indigenous to the rocks in which it is found? There are numerous objections to this theory. When and by what means could this organic matter have been converted into petroleum so completely that there is not the least residual trace of any of the original matter, nor any indication of waste? Could it, like Prospero's pageant, all dissolve "and leave no rack behind"? Again, the long ages required for the decomposition of the carbonaceous material and formation of the subsequent strata, the expulsion of the water which must have been mingled with the deposits, the distillation to form oil—all accompanied with violent changes in temperature and in the level of the petroleum strata—making it simply incredible that the oil could be preserved as now found.

The theory that petroleum has made its way as a gas into the sand strata—which have acted as a condenser to cool and turn the gas into liquid; and, then, as a sponge-like reservoir to hold it—seems the most acceptable. Carll summarizes this theory very forcibly:—

"This hypothesis also requires organic growth to furnish materials for generating the hydro-carbons and mechanical agents to prepare the sand-bed reservoirs to collect and retain them; but the operations of the two classes of agencies need not necessarily have been synchronous nor is it requisite that the areas primarily occupied by them should have been geographically co-extensive. The carbonaceous gas-producing materials may have been brought into the Appalachian basin from various sources at different times, and by many channels, long anterior to the deposition of the sand-beds. * * * *

"When we reflect that large quantities of organic matter were stored in the limestones and shales of the immensely thick beds of the Silurian formation, that they were augmented in a later period by the contents of other rich carbonaceous deposits of Lower Devonian age, that these all now lie far below the oil sands, and that we may reasonably suppose many of them are now or have been buried at a depth which would sub-

ject them to a degree of heat competent to all the requirements of spontaneous distillation of gas, we cannot but admit, in view of the known intimate relationship and association of gas and oil, that the hypothesis of the formation of petroleum from this source is worthy at least of a candid consideration."

We have extended this review of what may seem to some a strictly scientific phase of our subject, because we are convinced that the practical value of such work and study has been underestimated. How the oil has been formed and deposited may be of little interest to the producer; until he considers that, if the oil is indigenous to the sand rock, it is simply necessary for him to trace that rock, and expect to secure oil wherever the rock can be found. If, however, the oil is condensed gas or vapor, brought from other formations, it has probably been collected since the change in level of the sand strata; and so, in addition to having to find the kind of rock requisite for oil bearing, he must also find it within what the geologists term a definite horizon; and no oil deposit is to be expected wherever the strata have been elevated too near the earth's surface, or depressed too far below it.

Another question of great practical importance is closely connected with the one we have just considered; namely, the possible limitations to the production of petroleum. It seems at first difficult to comprehend how a stratum of rock, as compact in its formation as many of the oil sands appear to be, can hold quantities of liquid so enormous. In fact, in the early days of the industry, it was generally supposed that the oil was collected, if not in streams, at least in pools in the subterranean caverns technically termed crevices. All paying wells were believed to start from such a fissure in the rock. A "crevice-searcher" was invented and patented; by which the skilled operator claimed to be able to locate these crevices, and determine their depth. Some even went so far as to profess to describe the character of the strata, as their instruments passed down the bore of the well. That there are these fissures is undoubtedly true. They often annoy the well-drillers not a little, throwing the tools out of plumb and starting a "crooked hole"; and doubtless these crevices in the sand stratum are often filled with oil: but that they are not a necessary adjunct to a paying well has been clearly shown by the rough calculation of Carll. He says:—

"If we examine a piece of oil rock brought up after a torpedo has been exploded, or some of the third sandstone taken by hand from the stratum in place and laid open to view at the bottom of a large oil shaft sunk by blasting, at Tidioute, we shall find it simply a conglomerate of pebbles seldom larger than grains of wheat, loosely held together in a matrix. At first sight it hardly seems possible for any large quantity of oil to pass into a well through the interstices between the pebbles, but experiments made in a crude way on a number of pieces of this oil rock proved quite conclusively that it is capable of absorbing and holding from *one-fifteenth to one-tenth of its own bulk of water or oil;* this, too, when the pores of the rock are more or less clogged with residuum from

the oil previously held by it, and without its being charged under pressure."

He then makes a calculation to show how easily it can be proved that even a flowing well need not depend upon a crevice for its source of supply. With a bed five or ten feet thick and a strong pressure behind the oil, it is clear that the charged pores of the sand could readily yield several thousand barrels of oil per day:—

"The diameter of an ordinary well being $5\frac{1}{2}$ inches, the circumference of the circle is, therefore, $17\frac{28}{100}$ inches and the area of its cross section $23\frac{76}{100}$ square inches. Suppose the interspaces of the oil rock to amount in proportion to its whole bulk, to only one-seventeenth, instead of one-fifteenth, or one-tenth, as we have ascertained it to be in some cases; then for every inch of depth drilled in an oil sand, by which $17\frac{28}{100}$ square inches of its surface is laid bare (saying nothing about the bottom area of the whole) we shall have at least one square inch of oil ducts venting into the well. A depth then of $23\frac{76}{100}$ inches would give $23\frac{76}{100}$ square inches as the combined area of the inflowing oil leads, and this equals the full capacity of the $5\frac{1}{2}$ inch hole. In other words, the aggregate sum of the pores or interspaces of a sand rock of this kind, as exposed in the walls of a well of $5\frac{1}{2}$ inches diameter, is equivalent to the area of an open crevice one inch wide, extending from top to bottom of the gravel bed, whatever its thickness may be."

This calculation will serve to account for the enormous yield of certain wells and districts. If not, a table which he gives, and which we copy, will explain the possibilities of the porous sandstone acting as a sponge to store the "lakes of oil" which the early drillers claimed existed as distinct bodies of liquid:

Superficial Quantities.

43, 560 square feet in an acre,
27, 878, 400 square feet in a square mile,
6, 272, 640 square inches in an acre,
4, 014, 089, 600 square inches in a square mile.

Cubical Quantities.

9, 702 cubic inches in a barrel of 42 gallons,
56, 147 cubic feet in a barrel of 42 gallons.

Production of Oil Per Acre.

646.53 barrels if the sheet of oil be 1 inch deep,
1, 293.06 barrels if the sheet of oil be 2 inches deep,
1, 939.59 barrels if the sheet of oil be 3 inches deep,
4, 997.68 barrels if the sheet of oil be 7.73 inches deep.

Production of Oil Per Square Mile.

514, 779.65 barrels if the sheet of oil be 1 inch deep,
827, 559.30 barrels if the sheet of oil be 2 inches deep,
1, 241, 338.95 barrels if the sheet of oil be 3 inches deep,
3. 198, 515.20 barrels if the sheet of oil be 7.73 inches deep.

The same kind of calculation will give some idea of the enormous quantities a given territory can yield. Carll shows by his imperfect experiment that a sand may hold one-tenth of its bulk in oil. He believes that much of the rock holds one-eighth of its bulk, and more, when it is borne in mind that the oil is under pressure. This means $1\frac{1}{2}$ inches of oil to every vertical foot of sand, equal to 1,000 barrels per acre. He states that the oil rock of the Venango crude is from 30 to 50 feet thick in the third sand, and from 15 to 30 feet thick in the other sands. Assume 15 feet only of good rock; this means 15,000 barrels per acre, or nearly 10,000,000 barrels per square mile. Nature has been bountiful in her provision.

There are many facts pointing to the theory that the oil-producing sands lie in pockets or patches surrounded by impervious rock; so tha each pool forms a separate, and, to a very large extent, an independent reservoir of oil. Mr. Carll cites several instances which can be explained by no other theory:—

"Pithole was practically exhausted in 1867. Yet Cashup, only two miles to the northeast, lay undiscovered until 1871. When the latter district was tapped, it exhibited all the normal conditions of new territory, a tremendous pressure of gas and an abundance of lively oil, which attested their energy and force by a well flowing over 1,000 barrels per day.

"Shamburg was discovered several years after the Oil creek rock had been practically drained, and although not more than three miles from the world-renowned Noble well district, no direct communication has ever been traced between the two oil fields.

"Bullion, the champion district of 1877, lay with its wonderful store of oil and gas within a mile and a half of Scrubgrass, unaffected by the drainage and almost complete exhaustion of the latter six or seven years before.

"Butler and Clarion are now constantly furnishing new pools outside of previously developed areas, which show no symptoms of having been interfered with or weakened by any of the previous operations."

OIL WELLS AND TOOLS.—Most of the people of Pennsylvania are familiar with the sight of an oil well derrick. There is probably one standing for every square mile in the state. On January 1, 1890, there were 31,768 producing wells, according to the census report for that year. Undoubtedly there were more than enough other derricks standing to bring the total up to the number of square miles, 45,255, in the entire state.

While the derrick is the most conspicuous feature of an oil well, it is not the only important part even of the portion above ground. The construction in sight, taken as a whole, is called a "rig," being the work of carpenters. The derrick itself consists of a tall pyramidal wooden skeleton about 12 feet square at the base and 75 feet high; tapering to the top, which is about three feet six inches square. The framework is held together by girths and braced by diagonals at frequent intervals. A ladder extends from the ground to the top. This

frame structure stands on heavy timber foundations called sills. At the foot of the derrick is the bull wheel; and, at the top, the crown pulley, used for raising and lowering the tools during the progress of the drilling, and for handling the tubing and sucker rods after the drilling is finished. There is, also, near the top, another pulley for lowering and raising the sand pump, to be described later; there being a separate reel at the base of the derrick for winding up the sand-pump rope. Motion or power for drilling is communicated from the band-wheel, which is connected with the engine, to a walking beam for drilling, and afterwards for pumping, by means of the pitman. The band-wheel also furnishes the motion for running up the tools by coiling the bull rope on the bull wheel and the sand-pump rope on its wheel. The walking beam is supported by the Samson post, set in the derrick foundation.

For a complete well there is also needed a boiler and engine properly housed or protected. Often many wells are pumped by a single engine placed at some central location, communicating its motion to as many as 30 or 40 wells by means of stiff rods made of strips of wood nailed together, suspended by cords from posts at proper intervals, or supported on light frames that swing easily as the rods move forward and back. The power required is reduced to a minimum by a skillful balancing of the upstroke of the pump by means of weights placed at the end of the walking beam; the engine furnishing power to produce the downstroke only. The same result is at other points accomplished by balancing the wells in pairs, so that the pump rods of one go down as those of the other come up. By clever contrivances in the way of rocking levels, knuckle-joints, elbows and tees, the lines are carried up and down hill, and are made to turn at any desired angle. Where wooden connections cannot be made, on account of the irregular surface of the ground, several wells are sometimes connected together and worked by an endless wire rope carried for considerable distances on wheels for supports. Where more power is required than in the cases referred to above, the boiler is sometimes placed in a central location, and steam carried, through lines properly protected by some non-conducting covering or in an encasing box filled with non-conducting material, to the engines located near several neighboring wells.

In 1880, the figures furnished the census bureau show the cost of derricks to have been $325 to $400; and the rig-irons, such as bolts, pulleys, hooks, etc., $75 to $100 additional. The cost in 1890 is reported, for rigs, $200 to $275; and the rig-irons, $70 to $80 additional. We give elsewhere the full figures sent the government bureau for the census report.

With the rig built, and the boiler and engine set up, the sinking of the bore-hole or well proper can be commenced. In the early days, a wooden box called a conductor was first put down to the bed rock, through the surface clay or gravel constituting the unconsolidated de-

posit of drift lying above the upper stratum of rock. Where it became necessary to go down several hundred, instead of several, feet before the rock was reached, as is often the case in valleys, a pipe was driven down through the soft formation. This is the general practice now; the first section of a well from the surface of the ground to the first solid rock, consisting of a driven pipe eight inches in diameter, or larger. This is necessary to keep the earth from caving and choking the well, or the surface water from seeping into it and giving trouble. The drive pipe is put down in exactly the same way as piles are driven; the derrick serving as support for the pipe, and as guide for the heavy maul as it goes down. This pipe has to be cleaned out in the same manner as the bore that is afterwards carried down through the rock.

The hole through the rock is now begun. If the driven pipe is long enough, the work is started and carried on regularly; but frequently there is not room to start off with a full string of tools, as they require at least 60 feet before they can begin their work. In such cases the upper part of the bore has to be made by "spudding"; the auger, or drill, being suspended on a rope running up over the pulley at the top of the derrick, and raised and lowered by the skillful manipulation of the end of the rope in the hands of the driller, it having been first carried around the bull wheel which is kept in motion by the engine. This is continued until the regular string of drilling tools can be used. Such a string consists of the drill at the bottom to pulverize the rock. This is composed of the bit (or sharpened end of the drill), the auger stem, thirty or forty feet in length, and weighs, with the lower part of the jars, over 1,300 pounds. Next comes the sinker-bar, fifteen feet in length, which, with the upper part of the jars, weighs nearly 800 pounds. The sinker-bar is hung on the cable running up to the mouth of the well. The drill itself is not fastened directly to the cable, but to the lower part of the jars. The upper part of the jars is fastened to the sinker-bar; which, in turn, is fastened to the drilling rope. The jars are therefore the connection between the drill at the bottom and the cable above, and form very important parts of the drilling tools, and of the work they do. They are a wonderfully clever device, difficult to describe without a drawing. The upper wing of the lower part, and the lower wing of the upper part, are slotted, so that there is a play of more than a foot, by means of which a sudden blow can be given either on the upward or downward movement of the tools, as desired. The drilling is done entirely by the auger or lower section of the tools, the sinker-bar above serving simply to give steadiness to the tools by its weight. The jars are to give a blow to the auger stem on the upward stroke, to loosen the bit in case it becomes wedged in the rock it is cutting, as it frequently would do, if it were fastened directly to the cable, and the stretching of the rope would admit of the motion of the walking beam without moving the drill.

Carll's explanation of the manner in which the jars perform their work will perhaps help to an understanding of their function:—

"Suppose the tools to have been just run to the bottom of the well—the jars are closed—the cable is slack. The men now take hold of the bull wheels and draw up the slack until the sinker-bar rises, the 'play' of the jars allowing it to come up thirteen inches without disturbing the auger-stem. They watch for the coming together of the cross-heads, which will be plainly indicated by a tremulous motion communicated to the cable and by the additional weight of the auger-stem. When the jars come together they slack back about four inches, and the cable is in position to be clamped in the temper-screw.

"If now the vertical movement of the walking-beam be twenty-four inches, when it starts on the up stroke the sinker-bar first moves; it rises four inches—the cross-heads come together with a sharp blow, and the auger-stem is picked up and lifted twenty inches. On the down stroke the auger-stem falls twenty inches, while the sinker-bar goes down twenty-four inches to telescope the jars for the next blow coming up. This is the theory of the movement, but of course in practice the spring of the cable in deep wells and the weight of tools may make many modifications necessary."

The string of tools—the bit, the auger-stem and jars, with the sinker-bar—are more than sixty feet long and weigh very nearly a ton. The cable holding the string of tools runs up over the pulley at the top of the derrick down to the large wheel at its foot. Upon this wheel it can be coiled to draw the tools out of the well, whenever it is found necessary to sharpen or replace the bit, or clean the bore of the pulverized rock at the bottom. This cable is fastened at the end of the walking-beam already described. By the upward and downward swing of this walking-beam a motion amounting to two feet or more, the tools are lifted and dropped at the bottom of the hole, often 1,000 or more feet down. The connecting link between the walking-beam and the cable is the temper-screw. It lowers the tools a little at every stroke.

The pulverized rock formed by the impact of the tool is held in suspension by water poured into the well from the top until there is sufficient to impede the progress of the work. The tools are then drawn up out of the hole, and a sand-pump lowered, which, on being withdrawn, brings up with it the accumulation of broken rock and sand. Sand-pumps are of various descriptions, but in general consist of a cylinder with a valve in the bottom.

We have made no effort to describe the innumerable minor appliances found serviceable in well-drilling. It would almost be an "endless task to describe and illustrate the thousands of fishing tools that have been invented and used by the driller and well manager to meet the varied accidental emergencies daily occurring in well boring and well pumping. These tools are of all kinds, from the delicate grab designed to pick up a small piece of valve leather or a broken sucker-rod rivet from the pump chamber to the ponderous string of 'pole tools,' containing tons of iron, which at a depth of 1,500 feet or more, can unscrew a set of

'stuck tools' and bring them up piece by piece, or cut a thread upon the broken end of a sinker-bar or an auger-stem, so that it can be screwed fast to and loosened by the use of 'whiskey jacks' at the surface."

The wells first put down consisted of a four-inch hole bored wet (or with the well full of water until completed and pumped out) down to the producing sand. In this four-inch hole two-inch tubing extended to the bottom, with a seed-bag at what was thought to be the proper place. The seed-bag is a bagging of some sort placed on the tubing to fill up the space between it and the rock through which the well is bored. This contrivance is required to prevent the water in the bed-rock from flowing into the well, making it necessary to pump out water with the oil. When wells were bored wet, or full of water, it was a matter of guess-work where to place the seed-bag, and a great step forward was taken when it was found practicable to drill wells dry, for then it was possible to decide, as the well progressed, how far down it would be nessary to provide for the flow of water from the strata through which the hole was bored. A dry hole also gives notice as soon as a vein of oil is reached, the crude appearing in the sand-pump cleanings, if it is not forced up through the bore by the pressure from below. If a well starts with an eight-inch drive-pipe, that sized bore is carried down beyond the veins of water, and then gradually made to taper by using smaller drilling tools, to a five and one-half inch hole. A five and five-eighth inch casing is then put down inside the eight-inch drive pipe, and below it, until it strikes the point where the hole is reduced in size, forming at that point a tight joint with the rock and shutting off all water from above from flowing into the well. The five and one-half inch hole is continued to the producing sand, and inside of this five and one-half inch hole, a two-inch tubing is now placed, extending to the bottom of the well, terminating in what is called the "anchor," a perforated casing admitting the oil from the surrounding rock into the pipe to be pumped to the surface of the ground. There are then down to the bed-rock three pipes, one inside of the other; the outer eight-inch or drive pipe, then a five and five-eighth inch casing, and inside of the two a two-inch tubing for pumping the oil. The two latter extend to where the hole is reduced to five and one-half inches, when the outer one of the two, the casing, terminates, and the oil tubing extends alone to the bottom of the well. On this two-inch pipe, which is in the five and one-half inch hole, a water bag is placed somewhere below the point where the casing terminates; generally at the top of the oil sand, filling the hole between the rock and the pipe. It serves a double purpose, keeping above it any water that may have leaked down through the casing or come into the bore below the casing, and holding the gas from the oil stratum from reaching the surface of the ground by any other channel than the oil tube. This puts a pressure on the oil in the tube, relieving to an extent the force required for pumping, and in many cases

forcing the oil to the surface at intervals without any pumping whatever. We have described the putting down of one well. In 1889, 5,471 wells were drilled, and in 1890, 6,437. The figures will give some intimation of the magnitude of this industry.

Cost of Wells.—We scarcely hoped to be able to secure accurate figures showing the cost of oil wells. Much of the work has always been done by contract, and the contractors are of course reticent about disclosing the actual expense. Individuals or corporations making successful ventures have often at the same time been carrying on others that have proved complete failures, and no attempt has been made to keep the results separate. The speculative features of the industry also have inevitably led to the concealment or falsification of records. Carll, in his report for 1880, gives detail figures, which, he says were furnished him by a large producer in the Bradford field, as representing the cost of a well drilled in December, 1878:—

"Carpenter's rig complete,	$350 00
Belt, bull-rope, engine, 'telegraph,' water pipes, steam pipes and fittings to connect boiler and engine,	100 00
Boiler (20 horse power) and engine (15 horse power) on ground,	750 00
Contract for drilling, contractor to furnish fuel, tools, cable, sand pump, line, etc., at 65 cents per foot, say 1,500 feet,	975 00
Casing, say 300 feet at 80 cents per foot,	240 00
Tubing, say 1,600 feet at 20 cents per foot,	320 00
Torpedo (almost universally used before tubing),	100 00
Packer,	25 00
Working barrel,	8 00
Casing head,	3 00
Tees and elbows to make tank connections,	5 00
One twenty-five barrel tank,	25 00
One two hundred and fifty barrel tank,	110 00
Tank house,	25 00
Expense of tubing and packing well,	20 00
Expense for hauling, tubing, materials, etc., say,	50 00
Total cost of well, flowing,	$3,106 00

"In the above well no 'drive pipe' was used, a short wooden conductor set by the rig builder being all that was required. In localities where from 100 feet to 280 feet of drive pipe casing, costing $1.80 per foot, is required, the cost of a well is increased accordingly.

"If the well is to be pumped, the following items are to be added:

Fifteen hundred feet of sucker rods at five and one-half cents,	$82 50
Valves for working barrel,	7 00
Polished rod,	2 50
Stuffing box,	1 50
Adjuster,	5 00
Tees and elbows, etc., say,	2 00
	$100 50

"The necessary tools and implements for handling the tubing and sucker rods are—

Large pully block,	$11 00
Tubing elevators,	9 00
Three pairs of tubing tongs,	10 00
Tubing cable,	25 00
Sucker rod rope,	11 00
Sucker rod wrenches and elevators,	3 50

He also presents figures which, he says, were taken from the ledger of a company operating in the Butler field from 1862 to 1875. The costs seem to us to be very large:

Year.	*Well.*	*Depth.*	*How drilled.*	*Cost.*
1865,	No. 1,	1,120 feet,	by day's work,	$11,069 84
1866,	No. 2,	1,400 feet,	by day's work,	11,441 94
1868,	No. 3,	1,111 feet,	by day's work,	6,116 16
1870,	No. 4,	1,262 feet,	by day's work,	10,405 62
1870,	No. 5,	1,105 feet,	by day's work,	7,827 88
1871,	No. 6,	1,290 feet,	drilling contract, $3,500,	8,132 86
1871,	No. 7,	1,414 feet,	drilling contract, 3,500,	8,401 41
1871,	No. 8,	1,345 feet,	drilling contract, 3,600,	9,047 80
1871,	No. 9,	1,065 feet,	everything furnished by contract,	5,750 00
1872,	No 10,	1,300 feet,	everything, $6,700; extras, $317.12,	7,017 12
1872,	No. 11,	1,200 feet,	everything, 6,300; extras, 380.95,	6,680 95
1872,	No. 12,	1,212 feet,	by day's work,	6,557 04
1872,	No. 13,	1,402 feet,	by day's work,	6,671 06

"Nos. 9, 10 and 11 were put down by contract, the contractor in each case to furnish the rig, boiler and engine, casing, tubing and sucker-rods, and to drill the well to the oil rock and tube and test it for the price named. The extras are for drilling deeper after finding the oil sand unproductive."

For the United States Census of 1880, and again for that of 1890, careful statistics were laboriously collected at considerable expense on this and other features of the petroleum industry. We refer to these figures elsewhere at length. During the census year 1880, the Bradford district was at its height, 3,080 wells being completed in that one year. The rigs cost from $325 to $400, each averaging, say, $362.50. The engines and boilers cost $210 per well, drilling cost an average of $1,100, pipe and tubing, $660; torpedoes, $300 per well, a total of $2,632.50. In the Lower Country the average cost of 335 wells drilled during the year is put at $2,062.50. We give the details of these figures elsewhere. For the census of 1890 the records were made for 1889. The cost would seem to have been, for rigs about $300 per well; labor drilling, about $500; boiler and engine about $500; pulleys, ropes, etc., about $75; casing and tubing about $400, a total of about $1,775.00.

TORPEDOES.—Henry, in his *Early and Later History of Petroleum*, outlines Colonel Roberts's discovery that the production of oil wells could be greatly increased by discharging an explosive at their bottom. Henry's work was published in 1873, and the reference to torpedoes was

A SHOT WELL IMMEDIATELY AFTER EXPLOSION.

reviewed and approved by the inventor himself. We, therefore, place considerable reliance on the statements which we quote:—

"In 1862, Colonel E. A. L. Roberts, then an officer in the volunteer service, and with his regiment in the Army of the Potomac in front of Fredericksburg, conceived the idea of exploding torpedoes in oil wells for the purpose of increasing the production. He made drawings of his invention, and in November, 1864, made application for letters patent. In the fall of the same year he constructed six torpedoes, and on the 2d of January, 1865, he visited Titusville to make his first experiment. Colonel Roberts's theory was received with general disfavor, and no one desired to test its practicability at the risk, it was supposed, of damaging a well. On the 21st of January, however, Colonel Roberts persuaded Captain Mills to permit him to operate on the Ladies' well on Western flats, near Titusville. Two torpedos were exploded in the well, when it commenced to flow oil and paraffine. Great excitement, of course, followed this successful experiment and brought the torpedo into general notice. The result was published in the papers of the oil region and five or six applications for patenting the same invention were immediately filed at Washington. Several suits for interference were commenced, which lasted over two years, and decisions in all cases were rendered declaring Colonel Roberts the original inventor.

"Notwithstanding the success of the first experiment, operators were still very skeptical as to the practical advantages of torpedoes, and it was not till the fall of 1865 that they would permit the inventor to operate in their wells to any extent, from fear that the explosion would fill them with rock and destroy their productiveness.

"In December, 1866, however, Col. Roberts exploded a torpedo in what was known as the 'Wooden Well' on the Blood farm. This well was a dry 'hole,' never having produced any oil. The result of the operation secured a production of twenty barrels per day, and in the following month, January, 1867, a second torpedo was exploded, which brought up the production to eighty barrels. This established for the torpedo, beyond question, all that Col. Roberts had claimed, and immediately the demand for them became great all throughout the region."

The question of the validity of the patent was tested, and finally carried to the United States Supreme Court; where it was sustained. Justice Story, on behalf of the court, stated that "while the general idea of using torpedoes for the purpose specified is not patentable, the particular method of employing them invented by Col. Roberts is patentable; therefore he is entitled to protection." The report of the decision from which we take the above quotation gives a description of the way in which the torpedo was used, and outlines the theory of the inventor in reference to the manner in which the flow of oil is increased:—

"The patent consists in sinking to the bottom of the well, or to that portion of it which passes through the oil-bearing rock, a water-tight flask containing gunpowder or other powerful explosive material, the flask being a little less in diameter than the diameter of the bore, to enable it to slide down easily. This torpedo or flask is so constructed that its contents may be ignited either by caps with a weight falling on them or by fulminating powder placed so that it can be exploded by a movable wire or by electricity, or by any of the known means used for exploding shells, torpedoes or cartridges under water. When the flask

has been sunk to the desired position, the well is filled with water, if not already filled, thus making a water tamping and confining the effects of the explosion to the rock in the immediate vicinity of the flask, and leaving other parts of the rock surrounding the well not materially affected. The contents of the flask are then exploded by the means above mentioned, and, as the evidence showed, with the result in most cases of increasing the flow of oil very largely. The theory of the inventor is that petroleum, or oil taken from the well is, before it is removed, contained in seams or crevices, usually in the second or third stratum of sandstone or other rock abounding in the oil regions. These seams or crevices being of different dimensions and irregularly located, a well sunk through the oil-bearing rock may not touch any of them, and thus may obtain no oil, though it may pass very near the crevices; or it may in its passage downward touch only small seams or make small apertures into the neighboring crevices containing oil; in either of which cases the seams or apertures are liable to become clogged by substances in the well or oil. The torpedo breaks through these obstructions and permits the oil to reach the well."

Prof. S. F. Peckham quotes this notice of the decision, and then states that his own conclusions in regard to the effect of the explosion are somewhat different from that outlined by Col. Roberts:—

"While not disputing that in some instances the theory of the action of torpedoes formulated by Col. Roberts may explain such action, I am forced to the conclusion that when a torpedo is exploded in such a rock as the Bradford oil-sand the crushing effect of the explosion is comparatively limited. The generation of such an enormous volume of gas in a limited area, the walls of which are already under a very high gas pressure, and which is held down by a motionless column of air of 2,000 feet (the use of water tamping has been abandoned) must be followed by an expansion into the porous rock that drives both oil and gas before it until a point of maximum tension is reached. The resistance then becomes greatest within the rock, and, reaction taking place, oil and gas are driven out of the rock and out of the well, until the expansive forces originally generated by the explosion are expended. By this reaction the pores of the rock are completely cleared of obstructions, and the pressure of the gas within the oil-rock continues to force the oil to the surface until it is no longer sufficient for that purpose."

The success of the uses of the explosives was complete from the first. Henry states that the first thirty-nine wells shocked showed an increase in production of 2,227 barrels, or an average of 57 barrels per day per well; six of the wells showing an increase of from 125 to 200 barrels each.

In these early trials gunpowder was used, being lowered to the bottom of the wells in water-tight canisters; the well being filled with water as a tamping. A weight was slipped over the wire on which the torpedo was suspended, and, sliding down the wire, struck a percussion cap at the top of the canister, exploding the charge. Nitroglycerine is now used; and the charge has been increased to enormous quantities; in some cases as much as 100 quarts are used. The large quantity is employed, in order to shock at one time a wide section of the producing

TORPEDO OIL WELL.—A SIDE DISCHARGE.

sand; and the quantity of charge is regulated by the width of this sand. The explosive is lowered through the well bore in sections; one can of it being rested on another at the bottom of the hole, until sufficient has been put in place. A charge of 100 quarts of nitroglycerine will do the work of a ton of gunpowder. A cap is adjusted to the top of the last section; and, upon it, a weight is dropped down through the well, after the cord lowering the nitroglycerine has been withdrawn. A few seconds after the explosion a, fountain of oil, water, mud and pebbles shoots up through the well-mouth to the top of the derrick and above it; saturating it with oil, and scattering a shower of broken stones in every direction.

In Taylor's *Handbook of Petroleum* for 1884, a most graphic description of one of these explosions and of the results following is given. The increase in production of oil in this particular case was unusual, perhaps the largest on record:—

"October 27, 1884, those who stood at the brick school-house and telegraph offices in the Thorn Creek district to-day and saw the Semple, Boyd and Armstrong No. 2 torpedoed, gazed upon the grandest scene ever witnessed in oildom. When the shot took effect, and the barren rock, as if smitten by the rod of Moses, poured forth its torrent of oil, it was such a magnificent and awful spectacle that no painter's brush or poet's pen could do it justice. Men familiar with the wonderful sights of the oil country were struck dumb with astonishment, as they gazed upon the mighty display of Nature's forces. There was no sudden reaction after the torpedo was exploded. A column of water rose eight or ten feet and then fell back again, and some time elapsed before the force of the explosion emptied the hole and the burnt glycerine, mud and sand rushed up in the derrick in a black stream; the blackness gradually changed to yellow; then, with a mighty roar, the gas burst forth with a deafening noise; it was like the thunderbolt set free. For a moment the cloud of gas hid the derrick from sight, and then, as this cleared away, a solid golden column half a foot in diameter shot from the derrick floor eighty feet through the air, till it broke in fragments on the crown pulley, and fell in a shower of yellow rain for rods around. For over an hour that grand column of oil, rushing swifter than any torrent, and straight as a mountain pine, united derrick, floor and top. In a few moments the ground around the derrick was covered several inches deep with petroleum. The branches of the oak trees were like huge yellow plumes, and a stream as large as a man's body ran down the hill to the road, where it filled the space beneath the small bridge at that place, and, continuing down the hill through the woods beyond, spread out upon the flats where the Johnson well is. In two hours these flats were covered with a flood of oil. The hill-side was as if a yellow freshet had passed over it; heavy clouds of gas, almost obscuring the derrick, hung low in the woods, and still that mighty rush of oil continued. Some of those who witnessed it estimated the well to be flowing 500 barrels per hour. Dams were built across the stream, that its production might be estimated; the dams overflowed and were swept away before they could be completed. People living along Thorn Creek packed up their household goods and fled to the hill-sides. The pump station, a mile and a half down the creek, had to extinguish its fires that night

on account of the gas, and all fires around the district were put out. It was literally a flood of oil. It was estimated that the production was 10,000 barrels the first twenty-four hours. The foreman endeavoring to get the tools into the well was overcome by the gas and fell under the bull wheels; he was rescued immediately and medical aid summoned; he remained unconscious for two hours, but subsequently recovered fully. Several men volunteered to undertake the job of shutting in the largest well ever struck in the oil region. The packer for the oil-saver was tied on the bull wheel shaft, the tools placed over the hole and run in. But the pressure of the solid stream of oil against it prevented its going lower, even with the suspended weight of the two-thousand-pound tools; one thousand pounds additional weight was added before the cap was fitted and the well closed. A casing connection and tubing lines connected the well with a tank."

FLOODING. —Assuming that the oil-charged rocks lie in beds surrounded by harder impervious formations, so that each bed forms practically an independent reservoir saturated with oil and gas under great pressure, the pressure supposed at times to be as much as 300 pounds to the square inch; it will be clear that, as an outlet is given for the oil and gas, the pressure must be gradually reduced. There is good proof of this in the fact that the wells first drilled into a pool or section of oil-bearing rock yield best, even though they be only on the outskirts of the deposit; and wells put down later into the center of the bed do not yield so much, and always reduce the yield of the first wells. So long as the pressure continues, all the force is exerted outward and upward from the rock below, extending back from the sand immediately surrounding the bore further and further as the pressure is gradually relieved by the escape of the oil and gas up through the well. By natural law an equilibrium is being established. It finally is established when the well ceases to flow. If it is now pumped, a partial vacuum is formed. It is then that flooding, or filling of the oil rock with water to replace the oil and gas that have been sucked out of it, can occur. Producers try to guard against this. It is the practice, when wells have ceased to yield oil in renumerative quantities, to draw the iron casing out of them for use in other wells. Through carelessness, these abandoned wells are sometimes left unplugged; that is, the hole is left open instead of being filled with earth. Surface water is thus allowed to run down to the oil-bearing strata, and spread itself indefinitely until it reaches other wells in the same strata, and they begin to pump oil and water mixed and perhaps water only. This is so important a matter to the general welfare of the oil-producing region that a law has been enacted making it a misdemeanor for an owner to abandon a well and leave it unplugged. The penalty is $200 for each offense; one-half to go to the informer, and one-half to be turned into the fund for the use of schools in the district where the well is situated. The enactments are those of May 16, 1878, and June 10, 1881, quoted below:—

"Oil-wells to be plugged.

16 May, 1878, Sec. 1 (P. L. 56.)

All owners of and operators of oil lands within this commonwealth, shall in a practical manner plug their wells, at proper depth, with wood and sediment, in a manner sufficient to exclude all fresh water from the oil-bearing rock, and to prevent the flow of oil or gas into the fresh water.

"Penalty for omission. Ibid. Sec. 2.

Any person found guilty of violating the provisions of this act shall be fined in any sum not less than twenty nor more than one hundred dollars for each and every offense; which shall be paid, one-half to the informer and the other half to the school district in which the offense is committed, which shall be collected as fines of like manner are by law collected.

"Powers of adjoining owners in case of neglect. Ibid. Sec. 3.

Whenever the owner of any well has abandoned the same or does not reside in the county in which it is situated, any person owning property adjoining may enter in and take possession of any well, for the purpose of carrying out the provisions of the first section of this act, where the owner has refused or neglected to plug said well, so as to shut off the fresh water from the oil rock and exclude the gas and oil from the fresh water, as provided in section first, at the expense of the owner.

"How abandoned wells to be plugged.

10 June, 1881, Sec. 1 (P. L. 110.)

Whenever any well shall have been put down for the purpose of exploring for any producing oil, upon abandoning or ceasing to operate the same, the owner or operator shall, for the purpose of excluding all fresh water from the oil-bearing rock, and before drawing the casing, fill up the well with sand or rock sediment to the depth of at least twenty feet above the third sand or oil bearing rock, and drive a round, seasoned, wooden plug at least two feet in length, equal in diameter to the diameter of the well below the casing, to a point at least five feet below the bottom of the casing, and immediately after the drawing of the casing, shall drive a round wooden plug into the well, at the point just below where the lower end of the casing shall have rested, which plug shall be at least three feet in length, tapering in form, and to be of the same diameter at the distance of eighteen inches from the smaller end, as the diameter of the well below the point at which it is to be driven; (and) after it has been properly driven, shall fill in on top of same with sand or rock sediment, to the depth of at least five feet.

"Penalty for neglect. Ibid. Sec. 2.

Any person who shall violate the provisions of the act shall be liable to a penalty of two hundred dollars, one-half to be for the use of the informer, and one-half to the use of the school district in which such well may be situated, to be recovered as debts of like amount are by law recoverable.

"Powers of adjoining owners. Ibid. Sec. 3.

Whenever any owner or operator shall neglect or refuse to comply with the provisions of (this) section one of this act, the owner of, or operator upon any land adjoining that upon which such abandoned well may be, may enter, and take possession of said abandoned well, and

plug the same as provided by this act, at the expense of the owner or operator whose duty it may be to plug the same."

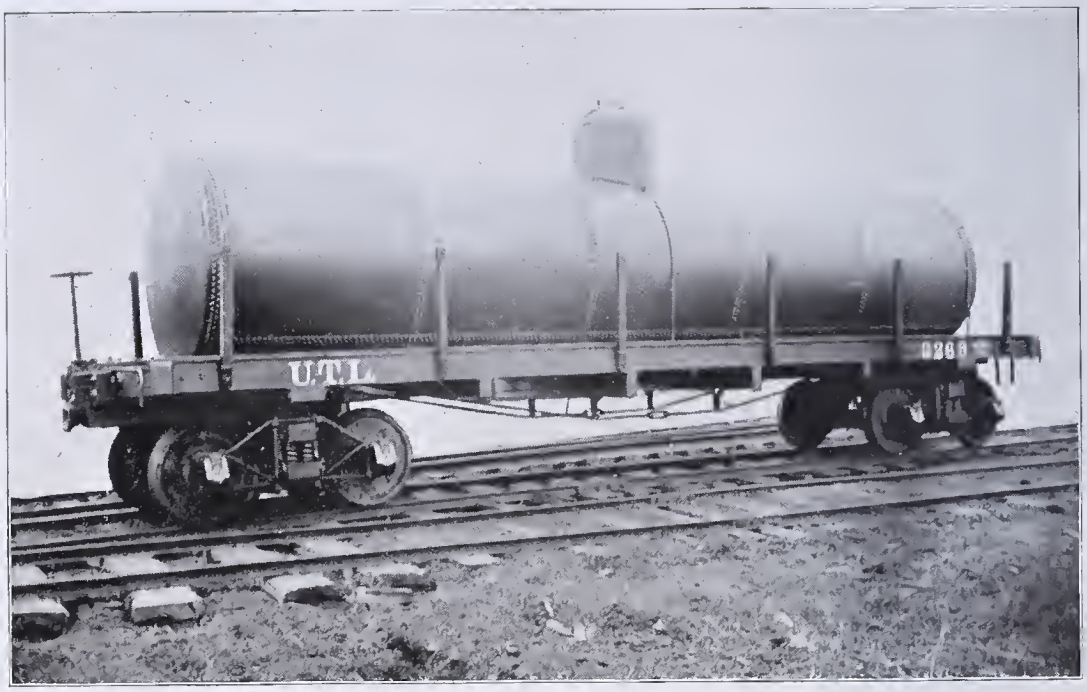
J. F. Carll reviews this general subject of flooding, at greater length than we have space to do. We quote two extracts from his report:—

"In judging of the probable effects of the introduction of water into any particular oil district several things are to be considered.

"(1). The time of flooding, whether early in the progress of the development, while yet a large percentage of oil remains unexhausted, or at a later period after the supply has suffered from long continued depletion. (2) The structure of the rock, whether regular and homogeneous throughout, or composed of fine sand interbedding connected and irregular layers of gravel, sometimes lying near the top and at others near the bottom. (3) The shape of the area being flooded. (4) The position of the point at which water is admitted, in relation to the location of the surrounding wells still pumping oil. (5) The height (which governs the pressure) of the column of water obtaining admittance. (6) The duration of the water supply. It will readily be seen that a temporary flooding in comparatively fresh territory, such as frequently occurred in early days along Oil creek from the drilling of new wells without casing or the overhauling of old ones, where the seed bag was attached to the tubing in a primitive way, must necessarily be quite a different affair from one caused by a permanent deluge through unplugged and abandoned wells in nearly exhausted territory.

"In the former case the flood may be checked before much water has accumulated in the rock, and then the oil flow can be reclaimed after a few days of persistent pumping; in the latter the recovery of the oil is very uncertain, because from its long continued extraction a greater capacity has been given to the rocks for storing water, and this being supplied from scattered and obscure sources, there is little probability that it can be shut off, although most thorough and systematic attempts may be made to check it. * * * * * *

"The first intimation of the flooding of a district is given by an increased production from the wells affected by it. Old wells, without any observable cause, improve gradually, running up from five barrels per day to ten or twenty, or even fifty. After pumping in this way for some time the oil quickly fails and they yield only a few barrels of salt or brackish water. As the wave moves on, the wells in advance, one after another, are affected in the same way. In some districts the movement is quite rapid and wells are invaded and 'watered out' in quick sucession; in others it is so slow that large quantities of oil are obtained from those which are favorably located to receive a 'benefit.' Flooding a well is sometimes a very profitable way of closing up its career, inasmuch as it thus yields more in a few months than it otherwise would in years, and when the water reaches it, the owner knows at once what it betokens and stops work, thus saving the time and money usually expended in fruitless efforts to reclaim a well failing through natural decline."



AN OIL TANK CAR.

WAGON FOR RETAILING OIL.

TRANSPORTATION OF CRUDE PETROLEUM.

Early Methods.—Pipe Lines.—Pipe Line Pumps.—Pipe Line Tanks.—Cleaning Pipe Lines.—Loading Racks.—Pipe Line Companies.—Pipe Line Certificates.

Early Methods.—One of the first great problems which the oil producer had to solve was that of transportation. The market for his product was the refineries that had been constructed in some of the large cities, particularly at the seaboard, for the production of illuminating oil out of coal. The oil wells along Oil creek and the Allegheny river were at first many miles from a railroad, in a lumber district where there were often no roads or at best very poor ones. Those who have travelled in the oil region know that for several months of the year the roads are rendered almost impassable by the mud. Their condition in the days when they were merely trails up over the hills and through the valleys of the sparsely-settled country can be hardly imagined.

Oil City was the nearest shipping point; and Pittsburg, the large distributing center. Crude oil was put into barrels, loaded on trucks and hauled to Oil City. The loss was very great. The barrels, being old, leaked freely as they made their rough trip from the interior to the railroad. Barges were soon called into use and the barrelled oil loaded on them; or the barges themselves were made tank boats for holding the oil in bulk, and the load floated down Oil creek to the Allegheny river at Oil City. But Oil creek during most of the year was a shallow stream; and the novel plan of slack water navigation, known as a pond freshet or "pond fresh," was resorted to. The water in the streams tributary to Oil creek was held back by dams, until sufficient quantities had accumulated; and then, at a fixed hour, each body of water was in turn released, filling the main stream for a short time with a flood. On this the barges of oil were carried down to their destination, warning having been given so that the boatmen along the stream might be ready to take advantage of the tide as it passed. The body of water was not large in extent; and considerable skill had to be used in starting at the right moment, and in navigating the boat during the trip. If the start was made too late, the waters would pass ahead and leave the craft stranded. If it was made too soon, the barge might be caught in the boiling waters and the power to guide it lost. Henry, in his *Early and Later History of Petroleum*, speaks of this mode of transportation as follows:—

"Arrangements were made with the mill-owners at the head of Oil creek for the use of their surplus water at stated intervals. The boats were towed up the creek by horses, not by a tow-path, but through the stream, to the various points of loading, and when laden they were floated off on a pond freshet. As many as 40,000 barrels were brought out by the creek on one of these freshets, but the average was between

15,000 and 20,000. At Oil City the oil was transferred to larger boats. At one time over 1,000 boats, thirty steamers, and about 4,000 men were engaged in this traffic. At times, great loss occurred from collisions and jams. During the freshet of May, 1864, a 'jam' occurred at Oil City resulting in the loss of 20,000 to 30,000 barrels."

Losses were frequent. The barges collided with each other, or struck projecting rocks in their rapid trip. Therefore, when boats were introduced for carrying the oil from Oil City down the Allegheny to Pittsburg, larger and stronger ones were constructed.

In the meantime, in 1862, the Atlantic and Great Western railroad was carried into the oil region. In 1866, the Allegheny Valley railroad was opened up from Oil City, at the mouth of Oil creek, to Pittsburg; and a number of narrow gauge lines constructed as feeders into the heart of the producing country. At first the barrels were loaded on flat cars, but the water mixed with the oil dissolved the glue used for coating the inside of the barrels, and the leakage in consequence was so large that wooden tank cars were soon built with two wooden tubs or vats, each holding 2,000 gallons, placed on an ordinary platform car. This was the forerunner of the tank car of to-day. In 1872, cars consisting of a horizontal cylindrical tank of iron mounted on a four-wheel platform or railroad-truck, appeared. These were at first of no greater capacity than the wooden cars they displaced; but have been gradually increased in size as their plan of construction has been improved, until many of them are now of 8,000 gallons capacity each. Of these we will speak at length in our chapter on the domestic trade in oil products.

PIPE LINES.—The magnitude of the petroleum industry made it necessary to find some mode of transportation even cheaper than a railroad. By force of circumstances, barges and tank cars for oil in bulk displaced the truck carrying oil in barrels. The pipe line, in turn, displaced the car and boat. The introduction of this mode of transporting oil marks an era in the petroleum industry. The freight by rail amounted to five or six dollars per car from the region to New York. It was most economical, therefore, to refine the crude near the wells; so that freight need be paid only on the products desired, and the quantity to be moved reduced to a minimum. The country around Pittsburg and Oil City was filled with little works taking out of the crude the refined oil needed for export. When the idea of allowing the oil to flow from place to place through iron pipes was put into practical form, the cost of transportation was so much reduced that a few enormous refineries were built at the seaboard near New York, Philadelphia and Baltimore; and, on the shores of Lake Erie, near Buffalo and Cleveland, to do the work which the almost countless small refineries in the oil region had heretofore done. This meant a revolution in methods of manufacture and in costs. Careful search has been made in the existing literature on petroleum to

find the first reference to the use of a pipe line for the transportation of oil. The account given by C. L. Wheeler, quoted by Peckham from the Bradford *Era*, probably deserves this distinction:—

"He said, in substance, that the first suggestion of a pipe line for transporting oil, so far as he knew, was made to him by General S. D. Karns at Parkersburg, West Virginia, in November, 1860. Mr. Karns said that as soon as he could raise the money, he would lay a six-inch gas pipe from Burning Springs to Parkersburg and let the oil gravitate to the Ohio river, a distance of thirty-six miles. For some reason, this line was never laid. Some years after, Mr. Wheeler was unable to recall the exact date, a Mr. Hutchinson, inventor of the rotary pump which bears his name, conceived the idea of forcing oil through pipes, and explained his plan to John Dalzell and the narrator in the latter's office in Titusville. Subsequently Hutchinson's plans became a reality, the first pipeline being laid from the Sherman well to the terminus of the railroad at Miller farm, a distance of about three miles. The inventor's idea of the hydraulic pressure of a column of that length was certainly very exalted, and he took elaborate pains to prevent the breaking of pipes. At intervals of fifty or one hundred feet were air chambers like those on pumps, ten inches in diameter, for the purpose of equalizing the pressure. These queer protuberances gave the line the appearance of a fence with ornamental posts, and excited great curiosity. The weak point, however, was the jointing, which, as the pipes were of cast-iron and imperfectly finished at their ends, was very defective, and the leakage from this cause was so great that little, if any, oil ever reached the end of the line. It was a success theoretically but a mechanical failure. Thus the expectations for easy and cheap transportation for crude oil raised by the building of the first pipe line were ruthlessly dashed to the ground and the inventor discontinued his experiments in despair."

In 1862, we believe, a bill was introduced into our State Legislature to authorize the construction of a pipe line from Oil creek to Kittanning; but, owing to the vigorous opposition of those interested in teaming oil, it was not passed. Later a plan to lay a line down the Allegheny river to Pittsburg, for the same reason came to nothing.

Samuel Van Syckle, of Titusville, was the first to put down a working line. It was only four miles long, extending from Pithole to Miller's farm, and carried but eighty barrels per day. It demonstrated, however, the thorough practicability of moving oil in this way. The difficulty up to this time had been in making the joints of the pipe tight. Van Syckle overcame this; and, although his line faced an ascent of nearly five hundred feet, the oil was delivered at the further end practically without loss. This line, together with another laid in the same year by Henry Harley from Benninghoff run to Shafer farm, passed into the control of a corporation known as the Allegheny Transportation Company, by which it was operated.

The owners and drivers of oil wagons saw that this mode of transportation must soon deprive them of occupation and they did what they could to retard the progress of the work. They cut the lines, set fire to the tanks with which they were connected, and even threatened the proprie-

tors and managers with personal violence. An armed patrol and the arrest of the ringleaders by detectives soon quelled this outbreak. The pipeage of oil was a great general improvement, and personal interest had to yield. To-day the oil region is a network of pipes; and great trunk lines, pulsing with the moving oil, supply the needs of New York Philadelphia, Baltimore, Cleveland, Buffalo, Pittsburg, Chicago and of many intermediate points.

The growth, however, was gradual. Lines were first laid only to the refineries in the oil region, and to the railroads taking the oil out of the region. With the lengthening of the pipes and the increase of pressure to force the liquid to greater distances, men became more and more impressed with the possibilities of the new mode of transportation, and enthusiastic ones began to believe there was no point short of the seaboard to which the oil might not be sent. In 1875, an organization called the Pennsylvania Transportation Company was granted a charter with power to construct a pipe line to the seaboard. The only outcome of this venture was the building of various lines within the oil region. Short lines multiplied, and pipe after pipe from the producing fields to the refineries and railroad shipping points crossed and paralleled one another in every direction. Competing companies waged war upon one another, cutting rates to the point of doing business at an actual loss. When the producer had run his oil into the storage tanks of some of these concerns, he was not certain whether the certificate received (for they all issued certificates instead of paying cash for oil) had any value; yet he must either send the oil through the pipe nearest to him, or allow it to pass back into the earth from which it came. The concentration of these badly-managed competitive companies into some centralized organization with systematic and economical methods was a necessary consequence of the situation.

The United Pipe Lines' Association, first known as the Fairview Pipe Line, organized by Captain J. J. Vandergriff and George V. Forman, became the starting point for such a movement. This association was incorporated under the general act of April 29, 1874. Into it were merged from time to time the other local lines; the Antwerp, Oil City, Clarion, Union, Conduit, Karns, Grant, Pennsylvania, Relief, the Clarion and McKean divisions of the American Transfer Company, the Prentiss lines, the Olean pipe, the Union Oil Company's line at Clarendon, the McCalmont line, with others too numerous to mention.

The first trunk line was laid in 1875 from the lower oil country to Pittsburg. It consisted of 39 miles of four inch pipe running from Carbon Center in Butler county to Brilliant, a suburb of Pittsburg. The trunk line to Cleveland next followed; consisting of a six-inch line from Bear Creek to Hilliards, the first pumping station, and from there a five-inch line to Cleveland. The total length is about 111 miles. The trunk line to Philadelphia starts at Colegrove in McKean county, and extends

LAYING PIPE LINE.

about 235 miles to Philadelphia, six-inch pipe all the way. From Millway, the last pumping station before reaching Philadelphia, a five-inch branch runs down to Baltimore, a distance of about 66 miles. The Buffalo line is about 56 miles long, having its initial point at Olean, N. Y. It is four-inch pipe. The New York line consists of two six-inch pipes starting at Olean, N. Y., and running parallel to each other through the southern counties of New York State, to Saddle River, N. J., where the lines separate; one going down to the refineries at Bayonne, N. J., and the other going under the North and East rivers to the refineries at Hunter's Point, on Long Island. In addition to the two parallel six-inch lines, the New York line is looped at many of the stations; that is, extra lines are put in to relieve the pressure on the other lines and so increase somewhat their capacity: thus making the total length of pipe used 762 miles, the distance traversed by the line being 313 miles.

The Tide Water line of six inch pipe, extends from Rixford in McKean county to the refinery of the Tide Water Oil Company, Limited, at Bayonne, N. J., a distance of 284 miles.

The Southern Trunk line starts from Morgantown, W. Va., and extends to Philadelphia; a distance of 274 miles. This line is composed of six-inch and eight-inch pipe, the total length of pipe being about 364 miles.

We give below a table showing the actual length of each trunk line. In addition to this there are many other large lines connecting the various systems and different oil fields.

For example: Between Kane and Bear creek, a distance of 63 miles, there are five six inch lines; from Kane to Colgrove, there are 22 miles of eight inch pipe; from Colegrove to Olean, 30 miles of eight inch pipe. The total pipe, including these large connecting lines and the double lines and loops, amounts to 3,000 miles.

PITTSBURG LINE, four-inch pipe.		*Miles.*
Bear Creek to Pittsburg,		55
BUFFALO LINE, four-inch pipe.		
Olean to Buffalo,		56.25
CLEVELAND LINE, five-inch pipe.	*Miles.*	
Bear Creek to Simpson,	29.81	
Simpson to Warren,	30.23	
Warren to Mantua,	22.16	
Mantua to Cleveland,	28.59	
		110.79
PHILADELPHIA LINE, six-inch pipe.	*Miles*	
Colegrove to Hunt's Run,	23.41	
Hunt's Run to North Point,	25.90	
North Point to Pine,	25.73	
Pine to Latshaw,	45.40	

Latshaw to Millway,	51.94	
Millway to Philadelphia,	62.50	
		234.88

BALTIMORE LINE, five-inch pipe.

Millway to Baltimore,		65.80

NEW YORK LINE, six-inch pipe.	*Miles.*	
Olean to Wellsville,	28.54	
Wellsville to Cameron Mills,	27.91	
Cameron Mills to West Junction,	29.74	
West Junction to Catatonk,	27.37	
Catatonk to Osborne Hollow,	27.99	
Osborne Hollow to Hancock,	29.86	
Hancock to Cochecton,	26.22	
Cochecton to Swartwont,	28.94	
Swartwont to Newfoundland,	29.00	
Newfoundland to Saddle River,	28.77	
Saddle River to Bayonne, N. J.,	16.29	
Saddle River to Hunter's Point, N. Y.,	12.26	
Total (with loopings),		762.01

TIDE WATER LINE, six-inch pipe.	*Miles.*	
Rixford to Olmstead,	28.7	
Olmstead to County Line,	36.0	
County Line to Muncy,	53.5	
Muncy to Shuman,	33.9	
Shuman to Hudsondale,	27.65	
Hodsondale to Changewater,	52.5	
Changewater to Bayonne, N. J.,	51.5	
Total,		283.75

SOUTHERN LINE, eight-inch and six-inch pipe.	*Miles.*	
Morgantown to Watson,	33.88	
Watson to State Line,	35.82	
State Line to Knepper,	66.67	
Knepper to Millway,	75.42	
Millway to Philadelphia,	62.50	
Total (with loopings),		364.29

CRESCENT PIPE LINE (MELLON LINE), five-inch pipe.	*Miles.*
Greggs to Milbank,	about 48
Milbank to Ingleside,	" 24
Ingleside to Saxton,	" 30
Saxton to Mount Holly,	" 55

Mount Holly to Florinal,	about 40	
Florinal to Linwood,	" 60	
Total,		267

United States Pipe Line (Emery Line), double line, four-inch and five-inch pipe.

		Miles.
Titusville to Tarport,	about 65	
Tarport to Westfield,	" 60	
Westfield to Athens,	" 55	
Total (two lines),		360

The trunk lines carrying Pennsylvania crude are nearly 3,000 miles in length; but this does not include the network of two-inch pipes that fairly cover the producing country, and serve as feeders for the trunk lines. A representative of the Standard Oil Company appearing before a committee of the State Legislature, in February, 1891, testified that the total length of lines transporting Pennsylvania crude was undoubtedly 25,000 miles; or, as one of the senators put it, "a girdle for the earth."

The lines are usually laid under ground with bends, at intervals, to allow for expansion and contraction. The pipe for these trunk lines is made especially for them. It is wrought iron, lap welded, and comes in lengths of 18 feet. On each end coarse and sharp taper threads are cut, nine to the inch, and the lengths are connected with long sleeve couplings, also screwed taper. The pipe is tested to stand a pressure of 2,000 pounds to the square inch, made necessary by the tremendous pressure carried on some of the pumps. This is sometimes as high as 1,500 pounds. It can be appreciated by remembering that, in addition to overcoming the friction of the oil on the line, which increases enormously as the rapidity of the flow is increased, the large body of liquid is made to move with great speed. It was found that the friction on the 108 miles of six-inch pipe between Rixford and Williamsport, Pa., was equal to a column of oil 700 feet high—that is, had this line had a gradual descent amounting to 700 feet, the adhesion between the oil and pipe would have prevented any flow, with the pipe full of oil for the 108 miles.

At each station there are two or more storage tanks of from 30,000 to 35,000 barrels capacity, the oil being received from the station next before into one of the tanks, while the pump is emptying another. In this way the movement of oil through the trunk lines is made incessant. Most of the stations are also provided with duplicate pumping machinery so that there need be no interruption of the flow of oil even when one pump has to be stopped for repairs. The distance between stations averages 28 to 30 miles, but loops are sometimes laid around a station so that one pump has moved oil as far as 110 miles.

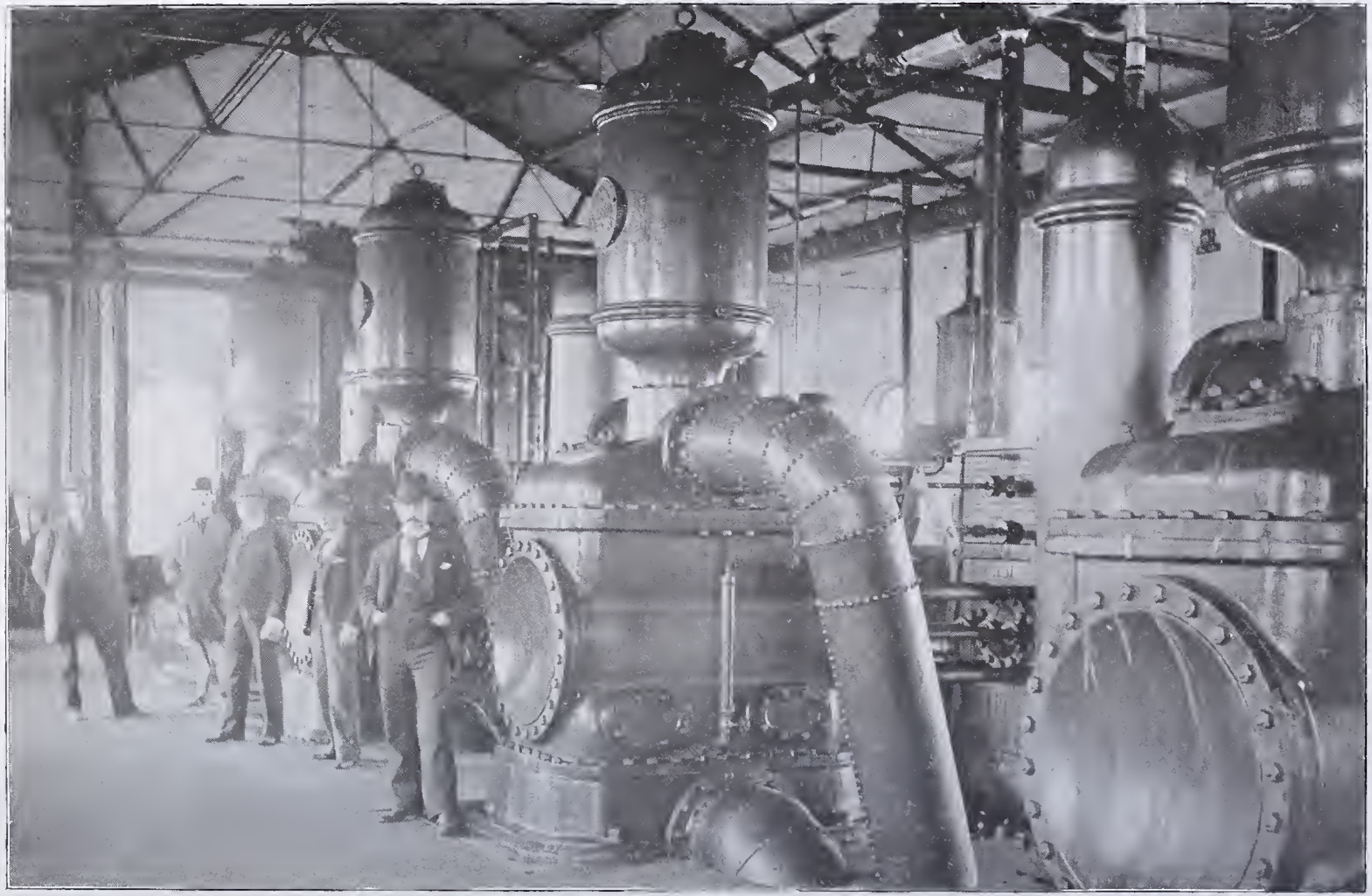
Where the New York trunk line passes under the Hudson river it is double—that is, one pipe is placed inside of another with tight fitting sleeve joints. The jacket pipe has its ends separated by a space of 12 inches to permit the enclosed pipe to be screwed home. The sleeve is then pushed over the 12-inch gap, and the whole space between the pipes is filled with lead poured in melted. The line is held in place on the bottom of the river by two sets of heavy chains parallel with the pipe and about twenty-five feet from it, one on each side. Every 300 feet a guide chain connects the pipe with these lateral chains, and beyond each one of these connections an anchor, weighing over a ton, keeps the whole in place. The line crossing the salt marshes approaching the river is laid in a rectangular wooden box, filled with hydraulic cement to withstand corrosion.

PIPE LINE PUMPS.—The pumps employed for this severe service are magnificent machines. Most of them have been built by the Worthington Company. They have been described by the *Engineering News* and the *Scientific American* somewhat as follows:—

Each pump has four steam cylinders—two high and two low pressure—steam jacketed, each set working tandem, direct acting. Each pair of cylinders actuates two single stroke rams of the exterior packed type. The engineer thus has the only possible source of plunger leakage always before him. The steam, going from the high to the low pressure cylinder, passes through a receiver, where it is heated. The valve boxes are subdivided into small chambers, with leather-lined metallic valves with low lift and large surfaces. The general dimensions are:

Diameter of low pressure steam cylinder, ... 66″
Diameter of high pressure steam cylinder, ... 33″
Diameter of plungers, ... $9\frac{1}{4}$″
Stroke, ... $37\frac{3}{4}$″
Horse power, 440.
Average duty, 105,000,000 foot pounds per 100 pounds of coal.
Rated capacity, 1,500,000 gallons against a pressure equal to 2,000 feet head of water.

The disproportion of diameter between the steam pistons and pump plungers shows the nature of the service the pumps are designed to perform. To maintain an even pressure on the line a pair of compensating cylinders and plungers at the outer end of the rams take the place of the usual air chamber or fly wheel. These are two vertical cylinders, each mounted on trunions near its center. "A heavy pressure is maintained by the accumulator and fluid on the rear of the plungers, tending to thrust them out. As the rams of the main pump move outward from the center position the compensating cylinders swing on their trunions and take increasingly oblique positions as the pump gets nearer the end of its stroke. The compensating rams are forced out during this period and re-enforce the action of the steam, whose pressure is getting lower owing to expansion. On the return stroke the compensating rams are pushed back against the accumulator pressure, their cylinders swinging back to the perpendicular position. In this period, therefore, the action of the steam at a high pressure in the steam



PUMPS.

cylinder is resisted by the rams. As the stroke returns from the center in the other direction the compensating rams act as in the other half stroke. By thus opposing the action of the unexpanded and resisting the action of the expanded steam, an almost even action is preserved at all periods of the stroke, and a nearly constant pressure is exerted on the liquid pumped." By this means the column of oil is kept continually in motion without any violent concussion on the line, as is generally the case with a direct-acting pump. During the last few years the National Transit Company have been building their own pumps, constructing for trunk line service enormous triple expansion crank and fly wheel engines, which are superseding other makes of pumps on their lines. At each station there is generally one of these high-duty engines and a low-duty one for relief or emergency service. Most of the pumping is done by the machine just described, the other being employed when the main pump is being repaired or adjusted.

A station equipped with a high-service pump has also seven or eight horizontal tubular boilers, 80 to 100 horse power each. Six of the boilers are fired at once. They are placed in a boiler-house 40 feet square, built of brick and covered with a corrugated iron roof. The pumps are in a separate brick building, being separated for greater safety from fire. The stations are lighted by electricity, as the pump never stops moving the oil forward every day and night in the year. The stations are connected with one another and with the main offices of the pipe lines by independent telegraph wires. When a producer's tank is measured and accepted by a gauger and the oil passed into the pipe line, a report is telegraphed to the central station of that section of the field. A complete record of the capacity of each tank in the field is here kept by which the feet and inches of the oil indicated by the despatch are at once converted into barrels and placed to the credit of the producer on the books of the pipe line. By this means, at the end of each day, an accurate return can be made of the oil received; which, checked by an equally accurate report of the oil delivered, enables the pipe line to know their stocks at all times.

At each station there are two or more receiving or storage tanks built of light boiler iron; the usual size being about 90 feet in diameter, and 30 feet high. These tanks have conical roofs of wood covered with No. 20 iron. Each tank holds about 30,000 barrels of oil. A general idea of the plan of construction of storage tanks can be learned from the following specifications under which the tanks of many of the pipe lines are built:

[TABLE C.] SPECIFICATIONS OF STORAGE TANKS.

CAPACITY (BARRELS OF 42 GALLONS EACH) ABOUT.	1,000.	2,000.	3,000.	4,000.	5,000.	10,000.	15,000.	20,000.	25,000.	30,000.	35,000.
Diameter of tank, in feet.	30	30	30	35	43	54	66	78	86	86	92
Height of tank, in feet, ...	8	16	24	24	20	25	25	25	25	30	30
Number of rings in shell, ...	2	4	5	5	4	6	6	6	6	7	7
Thickness of first ring (Birmingham gauge), ...	No. 7	No 5	No. 3	No. 3	No. 3	No. 3	No. 3	No. 2	No. 1	No. 0	No. 00
Thickness of second ring.	No. 8	No. 6	No. 4	No. 4	No. 4	No 3	No. 3	No. 3	No. 2	No. 1	No. 0
Thickness of third ring, ...	. . . . .	No. 7	No. 5	No. 5	No. 5	No. 4	No. 4	No. 4	No. 3	No. 2	No. 1
Thickness of fourth ring.	. . . . .	No. 8	No. 6	No. 6	No. 6	No. 5	No. 5	No. 5	No. 4	No. 3	No. 2
Thickness of fifth ring, ...	. . . . .	. . . . .	No. 7	No. 7	. . . . .	No 6	No. 6	No. 6	No. 5	No. 4	No. 3
Thickness of sixth ring, ...	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	No. 7	No. 7	No. 7	No. 6	No. 5	No. 4
Thickness of seventh ring, ...	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	No. 6	No. 6
Thickness of bottom plates, ...	No. 7	No. 7	No. 7	No. 7	No. 7	No. 7	No. 6	No. 6	No. 6	No. 6	No. 6
Thickness of sketch plates, ...	No. 7	No. 7	No. 7	No. 7	No. 7	No. 7	No. 6	No. 6	No. 6	No. 6	No. 5
Size of bottom angle iron, in inches,	$2\frac{1}{2}\times2\frac{1}{2}\times5\text{-}16$	$2\frac{1}{2}\times2\frac{1}{2}\times5\text{-}16$	$2\frac{1}{2}\times2\frac{1}{2}\times5\text{-}16$	$2\frac{1}{2}\times2\frac{1}{2}\times\frac{3}{8}$	$2\frac{1}{2}\times2\frac{1}{2}\times\frac{3}{8}$	$2\frac{1}{2}\times2\frac{1}{2}\times\frac{3}{8}$	$3\times3\times\frac{3}{8}$	$3\times3\times\frac{3}{8}$	$3\times3\times\frac{3}{8}$	$4\times4\times\frac{1}{2}$	$4\times4\times\frac{1}{2}$
Size of top angle iron, in inches, . .	$2\times2\times\frac{1}{4}$	$2\times2\times\frac{1}{4}$	$2\times2\times\frac{1}{4}$	$2\times2\times\frac{1}{4}$	$2\times2\times\frac{1}{4}$	$2\times2\times\frac{1}{4}$	$2\times2\times\frac{1}{4}$	$2\times2\times\frac{1}{4}$	$2\times2\times\frac{1}{4}$	$2\times2\times\frac{1}{4}$	$2\times2\times\frac{3}{8}$
Thickness of sheets for light nailed roof, ...	No. 20	No. 20	No. 20	No. 20	No. 20	No. 20	No. 20	No. 20	No. 20	No. 20	No. 20
Thickness of sheets for tight riveted roof, ...	No. 12	No. 12	No. 12	No. 12	No. 12	No. 12	No. 12	No. 12	No. 12	No. 12	No. 12

Cleaning Pipe Lines.—All crude petroleum contains more or less amorphous or uncrystallized paraffine or wax. Water mixed with crude oil forms an emulsion or soapy deposit. The paraffine is known in the oil region as "sucker-rod wax," because it collects on the rods used for pumping wells. The emulsion is locally known as "B. S." These two sediments, together with the impurities naturally incident to the mining of petroleum and its transfer from point to point, gradually choke the pipe lines, particularly in colder weather. To clean them, a curious instrument called a "go-devil" is sent through the pipe. These scrapers or brushes have at different times been of various designs, the one now used being the improved instrument that experience has shown is best suited to the work. It is a spindle with a ball and socket joint near its center so that it can follow the bends in the pipe. This spindle is fitted with steel blades set radially. It is kept in position in the pipe by three arms both in front and rear, with a guide wheel on the end of each arm. Oblique vanes put in motion by the moving oil rotate the spindle and the steel blades scrape the pipe. At the rear end of the "go-devil" a piston that approximately fits the pipe, gives the instrument a forward motion, being impelled by the oil pumped through the line. Until within a few years, it was customary for men to follow the scraper in its trip, knowing where it was by the whirring noise it made; any obstacle being located by the stopping of the "go-devil." This is no longer thought necessary. A catch-box is placed at the other end of the line and the time of the trip is so well known that the arrival of the little traveler can be quite closely timed. But the lines are regularly patrolled to promptly detect any leaks, although the system of checking from tank to tank makes it impossible for any serious break to occur without detection.

Loading Racks.—Closely associated with the pipe lines in such a description as this should be the loading racks for filling tank cars on railroad sidings. There are very many of these, both in the oil region and at different points along the main trunk lines, and at their termini. From one car to an entire train of thirty to forty cars can be loaded at once at many of these racks. The construction is of the simplest character; and, in general, the same at all points. Perpendicular branches are carried up at intervals, equal to the length of a tank car, from the main oil line, which is run along the side of the track. These branches are each provided with a stopcock and a movable pipe of proper length to reach over into the dome of the tank car standing on the track; when moved into that position by a man passing from one of these upright branches to another, on a platform that has been erected at a convenient height. When the train of cars has been pushed into place on the track, these movable pipes are put over the platform down into the domes of the cars and the oil turned on. As many cars as the side track will hold can thus be loaded at the same time.

PIPE LINE COMPANIES.—The trunk lines are controlled by the National Transit Company; the Tide-Water Pipe Company, Limited; the Octave Pipe Line; the Southwestern Pennsylvania Pipe Lines; the Eureka Pipe Line Company; the Buckeye Pipe Line Company; the Southern Pipe Line Company; the Charles Miller Pipe Line; the Western and Atlantic Pipe Line; the Elk Pipe Line; the Crescent Pipe Line (Mellon Line); the Producers' Pipe Line; the Producers and Refiners' Oil Company, Limited; the United States Pipe Line (Emery Line), and the New York Transit Company. The first two mentioned are the most important. These companies move the oil from the region to the terminus of their lines. The National Transit Company does a very large proportion of the entire business. We believe it holds the original charter granted to Andrew Howard, and J. S. Swartz and others under the name of the Pennsylvania Company, by the Act of April 7, 1870. In 1880, it absorbed the business and plant of the American Transfer Company; and, on April 1, 1884, the business and plant of the United Pipe Lines—that branch of the organization being since known as the United Pipe Lines Division of the National Transit Company.

PIPE LINE CERTIFICATES.—The National Transit Company and the Tide-Water Pipe Company, Limited, are the only lines issuing certificates for crude petroleum received. These are printed acceptances for crude, and are negotiable the same as a certified check. We give below copy of a certificate of the National Transit Company.

Acceptance

No. . . . Oil City, Pa., ... 18 . .

NATIONAL TRANSIT COMPANY, (1,000)

Through its UNITED PIPE LINES division,

Deliver to . . . . . or order,

One Thousand barrels of crude petroleum (of 42 gallons each) on the following terms, which are agreed to by the holder hereof:

1. It is agreed that the petroleum mentioned in this order is held by the National Transit Company, subject to a transportation charge of twenty cents per barrel, and a storage charge which will be at the rate of twenty-five cents per day per thousand barrels, as long as the market price of certificate oil is below one dollar per barrel; thirty-five cents per day when the market price is from one dollar to one dollar and fifty cents per barrel, and forty cents per day when the market price is above one dollar and fifty cents per barrel; no change, however, to be made in rate of storage on account of prices going above or below the prices named, unless the market price remains above or below the specified point for thirty consecutive days, and that the point of delivery of such oil shall be within the United Pipe Lines Division.

2. It is further agreed that this order shall be returned to the National Transit Company for exchange within six months from date of issue, or be subject to a storage charge of one twentieth (1-20) of one cent per barrel daily thereafter until returned.

3. It is further agreed that the National Transit Company shall not, in any event, be liable for any loss of crude petroleum resulting from lightning, fire, storms or any other unavoidable causes, it being distinctly understood and agreed that any such loss or losses shall be charged pro rata upon all petroleum in its custody at the time of such loss or destruction, and that the quantity of petroleum called for by this order shall be reduced by its proportion of such loss or destruction.

4. It is further agreed that transportation and all accrued storage charges shall be paid on the amount so deducted.

Not good until accepted by . . . . . Agent at . . . . . .

Order Accepted.

No . . . . . Agent. . . . . Registrar.

The system of issuing these certificates is, briefly, as follows;

When a producer wishes to deliver oil from his tank, he notifies a representative of the pipe line, who measures the oil and gives a voucher for it, running it into the line. The oil thus received is treated the same as a deposit in a bank. Against it certificates are issued in lots of one thousand barrels each, at the request of the owner. It is in these that the Oil Exchanges deal. It is needless to take space to de-

scribe these exchanges located at New York, Oil City, Bradford, Pittsburg, Philadelphia, Titusville, and elsewhere; nor the speculation in oil certificates. The largest number of clearances reported for any one year, is that for 1886, footing up 4,593,379,000 barrels. This speculative feature of the industry has almost entirely disappeared. It is with some curiosity that we read in the U. S. Census Report, for 1880, the following, such excitement having now become so completely a thing of the past:—

"The fluctuations in the price of petroleum, during the census year, rendered a speculative investment in the article an object of exciting interest. June 1, 1879, was Sunday. The market opened on the 2nd, at 74⅜ cents per barrel. It continued to fall, with little disposition to rally, until on the 17th it closed at 64⅜; and after fluctuating between 65 and 68 for four days, it reached 75, and dropped to 69⅜ on the 25th. It hovered about 70 until the 9th of August, when it began to fall, reaching 64⅜ on the 27th. A slight rally held it at about 66 until the 7th of September, when an upward movement began, reaching 96¼ on October 9th. It remained near 91 until the 10th of November, when it again moved upward, reaching $1.27½ on the 21st, closing that day at $1.22½. On the following day it ranged between $1.22½ and $1.10⅝, closing al $1.18⅛, from which it rallied, reaching on the 2nd of December $1.28⅛. Between the 10th and 18th it ranged between $1.27½ and $1.10, and fluctuated greatly between $1.18 and $1.09 from this time to January 15, 1880, when it went down in three days to $1.05, and steadily declined with scarce a rally, till, on March 9, it touched 85⅝. It hovered between 85 and 90 till April 6th, when it again commenced to decline, reaching 71¼ on the 21st. On the 5th of May it closed at 72½, and by the 26th had again reached the latitude of 93¾, closing on the 31st at 98¾. It will thus be seen that the certificates of oil in tank were worth that year from 64⅜ cents to 1.28⅛ per barrel, and this variation of almost 100 per cent. occurred between August 27th and December 2d, an interval of only sixty-eight days."

EXPORTS OF CRUDE PETROLEUM.

Volume of Business.—Rules Governing Exports of Crude Petroleum.

Volume of Business.—Crude petroleum, as well as its products, is a staple article of commerce. In our chapter on statistics, we give in detail the quantity exported, since the inception of the industry, from both Philadelphia and the whole of the United States. The quantity exported in 1892 was, from

Philadelphia, 1,910,200 barrels (42 gallons each).
United States, 2,461,641 barrels (42 gallons each).

Nearly 80 per cent. of the total exports of the country were made from the port of Philadelphia.

Exports of crude petroleum in any considerable quantities are of a more recent growth than those of illuminating oils. The year ending June 30, 1880, shows the largest shipment of any year up to that time. The total amount was 28,297,997 gallons. Since then there has been, with the exception of one or two years, a steady increase in these exports. By 1885, they had become more than 81,000,000 gallons. By 1890, they were over 95,000,000 gallons. For the year ending June 30, 1892, they amounted to 103,592,767 gallons; and for the calendar year 1892 they were 103,388,934 gallons.

Rules Governing Exports of Crude Petroleum.—The rules governing transactions in this branch of the business are those of the New York Produce Exchange, contracts for shipments from Philadelphia as well as New York being made subject to them. We give below the rules that apply to crude petroleum:—

"Crude petroleum shall be understood to be pure natural oil, neither steamed nor treated, free from water, sediment, or any adulteration, of the gravity of 43 degrees to 48 degrees Béaume.

"When crude petroleum is sold in bulk, the quantity shall be ascertained by tank measurement, at the time of delivery.

"Crude petroleum in barrels shall be sold by weight, at the rate of six and one-half pounds net to the gallon.

"In the absence of any stipulation, crude petroleum, when sold in barrels, shall be understood to mean, so far as regards packages, such packages as were originally refined petroleum barrels, whose last contents was crude petroleum, refined petroleum or naphtha.

"When contracts for crude petroleum call for second-hand refined petroleum barrels (*i. e*, barrels whose last contents has been refined petroleum or naphtha) the sellers shall have the privilege of substituting new barrels, but they shall be glued.

"The weighing and verification of crude petroleum shall be governed by the rules applicable thereto under the head of refined petroleum."

STATISTICS ON CRUDE PETROLEUM.

Report of the Tenth United States Census.—Report of the Eleventh United States Census.—Prices of Pipe Line Certificates.—Production of Crude Petroleum.—Shipments of Crude Petroleum.—Stocks of Crude Petroleum.—Petroleum Wells.—Pipe Line Reports.—Exports of Crude Petroleum.—Capital and Labor Employed during the Year of the Eleventh Census.

REPORT OF THE TENTH UNITED STATES CENSUS.—Two carefully prepared and, as far as such information can be made so, accurate and reliable statistical reports on petroleum are now matter of record. The first is that of Prof. S. F. Peckham for the Tenth Census of the United States, covering the period of twelve months ending May 31, 1880. The second is that of Mr. Joseph D. Weeks for the Eleventh Census of the United States, covering the period of twelve months ending December 31, 1889. Both of these reports record the difficulty of securing returns absolutely accurate, more from the nature of the problems to be considered and the lack of reliable data than the unwillingness of individuals or corporations to furnish the information desired. These reports are invaluable; and, being separated by a decade, afford some interesting comparisons.

During the census year of 1879 Prof. Peckham found that 3,080 wells were completed in the Bradford field. By adding to this number the rigs rebuilt, he estimates the total number of rigs constructed during the year as 3,516. Each rig required in building forty days of labor; equal to a total for all the rigs completed during the year, of the continued labor of 468 men through the entire twelve months. Taking 75 per cent. of this number as skilled workmen at $2.50 per day, and the rest as ordinary laborers an $1.50 per day, $316,440 was expended for labor in building rigs. The material in the rigs cost on an average $362,50 each; 31,516 rigs cost, therefore, $958,1 0; which, added to the amount expended for labor, makes the total cost of the rigs in the Bradford field for that year $1,274,550. The investment for engines and boilers could be estimated only with difficulty, on account of the moving of both from point to point as required; some of them, therefore, being old stock of little value. Prof. Peckham was of the opinion that 90 per cent. of the wells in the Bradford district were supplied with engines and 60 per cent. with boilers, and adds; "I have been informed that at least one-half the wells drilled in the Bradford district during the census year were supplied with engines and boilers from wells abandoned in the Lower Country." For these he figures no cost. He values the engines employed at $278,200, and the boilers at $370,800; or an average for the engines and boilers for the 3,091 wells drilled during the year, of $210 per well. Two per cent. of the wells used for fuel the natural gas secured in drilling. Fuel for the other wells aggregated 302,400 cords of wood; the labor for cutting costing $272,160, five hundred men being needed for this work. Only the labor of cutting is counted in the cost, as the wood was taken from the land where the

wells were drilled. Two drillers and two tool-dressers, all skilled workmen, were required for each well. He estimates that a year's labor of a skilled workman should be figured for every two wells put down. This means, say, 1,500 men for the year; or, at $3 per day, $1,350,000. There were required, in addition, 1,500 laborers; earning, say, $810,000. Drilling tools cost about $900, and were damaged to the extent of one-fourth of their value in drilling; each well representing, for the census year, an investment of $694,350. This amount shows the cost of the work to the driller. Most wells were drilled by contract. The well owner paid for drilling deep wells (averaging 2,000 feet each) 55 cents per foot. This represents, for the 3,086 wells drilled, $3,394,600. Prof. Peckham confesses: "Such estimates are hardly worth the name of statistics; but are, I believe, as close an approximation to accuracy as can now be made."

Each well required 30 to 100 feet of eight-inch pipe, 300 feet of $5\frac{5}{8}$ inch casing, and 2,000 feet of two inch oil tubing. The drive-pipe cost about $648,060; and the tubing, $925,800. He added for torpedoes $300 per well, or $925,800 for the year. His estimates, which cover the Bradford field only, are, then:—

Cost of 3,516 rigs,	$1,274,550
Engines and boilers for 3,091 wells,	649,000
Drilling 3,086 wells,	3,394,600
Piping 3,086 wells,	2,036,760
Torpedoing 3,086 wells,	925,800
Total for Bradford field for census year,	$8,280,710

Similar figures, which we will not give in detail, show, for the 335 wells drilled in the Lower Country, in the census year, an investment of $690,937. In addition to this, there was a large force of men employed in operating and repairing wells already drilled. Prof. Peckham put this at 2,000 men for the Bradford field, receiving $1,080,000 for wages during the census year; for the lower country, 4,500 men, receiving $2,700,000 in wages. He gives similar estimates for the minor districts of Franklin and Beaver district fields. These figures can be tabulated as follows:—

[Table D.]

Statistics of Capital and Labor Employed in the Production of Crude Petroleum During the Year Ending May 31, 1880.

	Bradford district.	Lower Country district.	Franklin district.	Beaver county district.	Total all districts.
Number of wells drilled,	3,080	335	120	15	3,550
Cost of rigs,	$1,274 550	$121,437	. . . . .	. . . . .	$1,395 987
Cost of engines and boilers,	$649,000	$100,500	. . . . .	$15	$749,515
Cost of drive-pipe,	$462,900	$50,250	. . . . .	. . . . .	$513,150
Cost of casing,	$648,060	$70,350	. . . . .	. . . . .	$718,410
Cost of tubing,	$925.800	$67,000	. . . . .	. . . . .	$992,800
Cost of torpedoes,	$925,800	. . . . .	. . . . .	. . . . .	$925.800
Cost of drilling,	$3,394,600	$281.400	. . . . .	. . . . .	$3,676,000
Total cost of wells,	$8,280.710	$690,937	$48,000	310,500	$9,030,147
Estimated number skilled workmen,	1,851	208	15	12	2,086
Estimated number ordinary laborers,	4,117	4,736	155	63	9,071
Total number men employed,	5,968	4,944	170	75	11,157
Total amount of wages paid,	$3,828,600	$3,012,300	$102,000	$45,000	$6,987,900

The cost of raising oil during the census year 1879 was given: For flowing wells in the Bradford district, as 6 to 8 cents per barrel; for pumping wells in the Lower Country, 80 cents per barrel; for pumping wells in the Franklin district, $3.00 per barrel.

REPORT OF THE ELEVENTH UNITED STATES CENSUS.—Ten years later, for the Eleventh United States Census, Joseph D. Weeks, Esq., collected statistics which, as might be expected, are much more complete and accurate. In New York and Pennsylvania, 5,435 wells were com pleted during the census year, which, in the case of his report, includes the twelve months ending December 31, 1889. Ten years before, the number of wells completed in the census year was 3,550. The number of producing wells at the end of the census year was 31,768, as compared with 14,384, at the end of the census year ten years before. The total number of laborers employed in producing crude oil was 19,691, as compared with 11,157 ten years before. The total wages paid was $7,288,736, as compared with $6,987,900 ten years before. It is difficult to carry the comparison in detail much further. Prof. Peckham limited his inquiries to labor statistics; Mr. Weeks's inquiries were more comprehensive, and his figures cover much more than those of the Tenth Census report. Mr. Weeks secured valuable information on the cost of drilling wells by contract in the Upper district, from Mr. J. S. Wilson, secretary of the well drillers' association, at Titusville. Coming from this source, such figures are of much interest; so we quote them somewhat at length:—

"Cost of rig, from $275 to $325; lumber in rig, from 8,000 to 10,000 feet, worth $8 to $11 per thousand; iron, $70 to $80; timber, besides the lumber mentioned above, $30 to $50; carpenters' work and grading, $75 to $90; carpenters' wages from $2 to $3.50 per day of ten hours.

"Relative to the cost of machinery, it is difficult to give exact information, as it is not known just how long machinery will last, its work being divided between drilling and pumping. Drilling machinery rents for drilling purposes, however, at from 10 to 15 cents per foot of drilling done, or from $50 to $75 for 30 days, the machinery including boiler, engine, pipes and fittings, belt and bull rope. Boilers used in the oil region cost from $275 to $425, engines from $150 to $180, belts from $30 to $50, bull ropes from $15 to $20, and pipes and fittings from $5 to $10.

"Drilling costs in the Upper region from 40 to 50 cents per foot. This includes cost of labor, fuel, wear and tear of materials, and rent of tools, including ropes, the first cost of tools and rope being from $800 to $1,000. The depth of the new wells of the Upper region is from 600 to 1,000 feet, the time consumed in drilling being from 8 to 15 days of 24 hours each, drilling being continued night and day. The cost of labor is as follows: Two drillers, at from $3 to $4.50 per day of 12 hours; two tool dressers, at from $2.50 to $3.50 per day; fuel 4 to 5 cents per foot of well drilled, and casing from 30 to 45 cents per foot. The amount used is from 150 to 400 feet. Tubing used, according to depth of well, at from 13 to 17 cents per foot; fittings per well, $12 to $25; sucker rods, 5 to 7 cents per foot. The amount of sucker rods used is

the same as tubing, varying with the depth of the well. The cost of drilling given above includes putting into the well the casing, tubing and rods, but not the furnishing of them.

"When the well is to be torpedoed, from 20 to 180 quarts of nitroglycerine are used, worth from 90 cents to $1 per quart."

Tables.—The following tables have been prepared with all possible care, and are probably the most accurate and complete ever published. We are indebted for assistance in their preparation to the *Derrick Hand Book of Petroleum*, to *Stowell's Petroleum Reporter*, the Statistical Bureau of the United States Treasury Department, to the Tenth and Eleventh United States Census Reports on Petroleum, and to the careful records of the National Transit Company and other branches of the Standard Oil organization. Our tables are the following:—

Table E.—*Daily prices of Pipe Line certificates from January 1, 1880, to December 31, 1892.*

We believe a daily report of these prices has never before been published for so long a period. The figures are of interest and importance, as storage charges on oil covered by certificates are dependent, to a degree, on the ruling prices for certificates on the exchanges. With crude oil at less than $1.00, the storage charges are 25 cents per day per 1,000 barrels; with certificate prices at more than $1.00 and less than $1.50, they are 35 cents; with certificate prices at more than $1.50 they are 40 cents per day; no change, however, is to be made in the rate of storage unless the price remains above or below the specified point for thirty consecutive days.

Table F.—*Average monthly and yearly prices of Pipe Line certificates from January, 1885, to December, 1892.*

We think this table covers a longer period than any that has been published to show the price of certificates.

Table G.—*Production of crude petroleum in the Pennsylvania fields, by districts, during the year 1888.*

Table H.—*Production of crude petroleum in the Pennsylvania fields, by districts, each month, during the year 1889.*

Table I.—*Production of crude petroleum in the Pennsylvania fields, by districts, each month, during the year 1890.*

Table J.—*Production of crude petroleum in the Pennsylvania fields, by districts, each month, during the year 1891.*

Table K.—*Production of crude petroleum in the Pennsylvania fields, by districts, each month, during the year 1892.*

It will be seen by the above tables that the producing territory is shifting from year to year, the classification or districting of the production being also somewhat different from year to year.

Table L.—*Total production of crude petroleum in the Pennsylvania fields, by months, from January, 1871, to December, 1892.*

TABLE M.—*Production of crude petroleum in the Pennsylvania fields, by districts, each year, up to December 31, 1880, as classified by Prof. S. F. Peckham for the Tenth United States Census Report.*

For explanation of this table see page 23.

TABLE N.—*Production of crude petroleum in the Pennsylvania fields, by districts, up to December 31, 1882, as classified by the Second Geological Survey.*

For explanation of this table see page 24.

TABLE O.—*Shipments of crude petroleum from the Pennsylvania fields by months, from January, 1871, to December, 1892.*

In some years, especially the earlier ones covered by this table, a considerable portion of the oil was shipped as refined. In this table that is reduced to its equivalent in crude, a barrel of refined being figured as produced from $1\frac{1}{3}$ barrels of crude. For the later years these shipments are chiefly what are known as Pipe Line deliveries. These figures are not to be taken as showing the actual consumption, as sediment, dump-oil (oil that does not pass through the pipe lines) and oil destroyed by fire and disposed of in other ways than by refining or direct consumption, should be added. There is also loss by evaporation and other causes provided for by the pipe lines in receiving the oil from the producers, 44 gallons being delivered and certificates issued for 42 gallons only to the barrel.

TABLE P.—*Stocks of crude petroleum in the Pennsylvania fields, by months and years, from January, 1871, to December, 1892.*

TABLE Q.—*Number of wells completed in the Pennsylvania fields, each month, by districts, during the year 1888.*

This table shows also the number of dry holes.

TABLE R.—*Number of wells completed in the Pennsylvania fields, each month, by districts, in 1889.*

TABLE S.—*Number of wells completed in the Pennsylvania fields, each month, from January, 1872, to December, 1892.*

TABLE T.—*Number of drilling wells in the Pennsylvania fields, at the close of each month, from January, 1871, to December, 1892, by months and years.*

TABLE U.—*Report of the National Transit Company, and certain other pipe lines, for the month of December, 1892.*

TABLE V.—*Report of the Tide Water Pipe Company, Limited, for the month of December, 1892.*

TABLE W.—*Quantity and value of crude petroleum exported from the United States, each year, from July 1, 1863, to June 30, 1892.*

TABLE X.—*Quantity and value of crude petroleum exported from Philadelphia, each year, from July 1, 1863, to June 30, 1892.*

TABLE Y.—*Quality and value of crude petroleum exported from each port, each year, from July 1, 1863, to June 30, 1892.*

Table Z.—*Capital invested in the production of crude petroleum in 1889; value of material used in pumping, caring for and operating wells, and average value of wells.*

This table is compiled from the census records for 1889. There were 873,393 acres of oil lands owned and leased. The average of the values reported is only $31.00 per acre Mr. Weeks comments:—

"It is evident to anyone at all acquainted with oil land that these averages are very much below the actual value of this territory as soil land. This class of land is worth to-day all the way from $100 to $400 an acre.

"Recent purchases in the Bradford district, one of the oldest, have been as high, where the fee has been bought, as $100 to $250 an acre, while it is almost impossible to place a value upon oil lands in the Washington district, or in several of the newer ones of the Southwestern fields. As is stated elsewhere, land was bought in 1889 at a valuation of $1,500 for each barrel of daily production.

"In leasing oil lands it is usual to pay a certain price for the lease, varying from $1 to $20 per acre, together with a certain proportion of the oil produced as royalty. This royalty varies from one-sixteenth to one-fourth of the oil produced, the almost universal custom being one-eighth. In estimating the worth of the oil land, the value seems to have been put by the producer, so far as it relates to the leased land, at the amount paid per acre for the lease, while probably a fair price, though a low one, has been placed upon the land owned. It is evident, however, that this valuation is not a fair one, as certainly it should be estimated with some reference to the price paid for land, when purchased in fee, having in consideration at the same time the amount of oil produced. Under these considerations it is believed that $100 an acre would be a very conservative estimate as the average value per acre of the owned and leased oil lands in Pennsylvania. At this figure the value of these lands would be $87,339,900 instead of $27,184,857."

Table AA.—*Total capital invested in production of crude petroleum in the Pennsylvania fields in 1889, other than that invested in lands, wells etc., covered by table Z.*

The items of tank cars and pipe lines do not include those owned by pipe line companies, or transportation companies, but only the property owned at the wells. This table shows a total of $62,377,151; which, added to the value of land, $27,184,857, makes a total investment in production of crude oil of $89,562,008. This investment would be increased to $149,717,051, if Mr. Weeks's estimate of the value of the producing land is accepted.

Table BB.—*Classes of labor and wages paid in the Pennsylvania oil fields in 1889, by districts.*

Table CC.—*Employments of labor in the Pennsylvania oil fields in 1889, by districts.*

This shows a total of $7,423,781 paid for labor in the census year 1889.

[TABLE E.] DAILY PRICE OF PIPE LINE CERTIFICATES,

1880.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
January,	. . .	. . .	. . .	. . .	1 11⅜	1 12⅝	1 12½	1 12⅞	1 13⅞	1 13⅝	. . .	1 13½	1 13½	1 13½	1 10⅜
February,	. . .	1 09	1 07¾	1 09	1 10¼	1 09⅜	1 09	. . .	1 09⅛	1 08½	1 08½	1 08½	1 05⅜	1 05⅜	. . .
March,	92½	91	92⅜	81	90⅜	89¾	. . .	87¼	86	87¼	87⅞	89½	88½	. . .	91¼
April,	85½	85⅞	86½	. . .	86⅝	85⅜	83½	81⅝	79⅛	77⅛	. . .	75¼	74	73⅜	73⅜
May,	73⅜	. . .	73½	72⅜	72⅜	75⅜	76⅝	77⅛	. . .	78⅜	75¼	77½	75½	76½	77⅛
June,	84⅜	90⅜	91⅝	94¾	94⅛	. . .	95½	95¼	94½	92½	94	93⅜	. . .	93½	94¼
July,	1 03½	1 14¼	. . .	. . .	. . .	. . .	1 13⅜	1 12½	1 12⅛	1 07¾	. . .	1 05⅜	1 04⅝	1 03½	1 01
August,	. . .	96½	94	94	94⅜	95¼	94⅜	. . .	93½	90⅜	86⅝	85⅜	87⅞	88½	. . .
September,	89⅜	89⅝	90⅞	89⅜	. . .	91	92½	93½	93½	95⅜	95⅝	. . .	94	95⅜	95⅜
October,	99	98⅜	. . .	96⅝	94¾	95⅜	99⅛	99½	98½	. . .	99	99	97¾	95⅞	97½
November,	95⅜	. . .	93½	91⅝	92¼	90⅜	. . .	90¼	89⅝	89⅝	89	88⅜	87⅜	. . .	88½
December,	91⅝	92¼	93½	92¼	. . .	93⅜	92¼	90⅞	92½	92½	91½	. . .	91	91⅜	92⅞

1881.

January,	. . .	. . .	95⅞	94⅝	95⅜	96½	95½	96½	. . .	96⅝	97¼	97¼	97¼	97⅜	96⅝
February,	91	90⅜	90⅜	89¾	89¾	. . .	90⅜	90¼	89⅝	89⅝	90¼	90¼	. . .	90⅜	90⅜
March,	85	85¾	85¼	86	86¼	. . .	87½	88⅜	86½	85⅞	84⅝	84⅝	. . .	85⅜	84¾
April,	81½	81	. . .	82½	84	84	85½	91⅛	91⅛	. . .	87½	85⅜	86	86⅜	. .
May,	. . .	80⅞	80¼	79⅜	79	80⅞	81½	. . .	80⅜	82¼	81	81	80⅝	81⅝	. . .
June,	81½	82½	82½	82½	. . .	82¼	82⅞	83½	83½	82⅞	82¼	. . .	82⅝	82⅛	82½
July,	79	77¾	. . .	. . .	78½	77⅞	78½	79⅛	78½	. . .	78⅜	76½	75⅜	75¼	74
August,	76⅝	76	76⅝	77¼	76	76⅜	. . .	76½	75⅜	74⅝	75¼	75⅜	75¼	. . .	79⅛
September,	84¾	85⅜	86	. . .	85¼	85¼	87½	. . .	89	92¾	. . .	96½	99	97	95⅝
October,	93⅜	. . .	93⅞	94¾	93⅜	93	92⅞	92½	. . .	92⅞	94½	94½	94	94⅜	94½
November,	85	85¼	85⅛	84⅝	83¾	. . .	83⅝	. . .	84½	84⅛	84¼	84½	. . .	84	83⅞
December,	81⅛	81⅜	83	. . .	86⅛	83⅝	83⅛	85⅛	84⅛	85¾	. . .	87¼	85½	84⅜	84¼

1882.

January,	. . .	. . .	80¾	79⅝	81⅞	81⅛	81⅛	. . .	81	81¼	81⅛	81⅜	81½	81⅜	. . .
February,	87½	88¼	87⅝	87¾	. . .	86½	85½	85¾	86⅝	87⅛	86½	. . .	87⅜	86⅞	85⅞
March,	81⅜	82⅛	82¼	81⅝	. . .	80¼	80	79⅛	78⅝	79¾	81⅛	. . .	81⅜	80	80¾
April,	80⅝	. . .	78½	78⅜	77⅞	78¼	. . .	79¼	. . .	78⅜	78	78¾	79⅜	79⅝	78⅞
May,	73⅞	74⅜	72⅛	72⅝	72¼	73⅜	. . .	74⅞	72¾	75½	75⅛	75¼	74⅜	. . .	74
June,	60½	60½	57⅞	. . .	57¼	57⅜	57¼	56⅝	54⅜	53⅞	. . .	52¾	54	53¼	51⅞
July,	52½	. . .	. . .	. . .	50⅞	49½	53	55⅜	. . .	58½	56⅜	58⅛	57⅛	57⅞	57⅝
August,	61⅛	60	59⅛	60½	60⅝	. . .	60	59¼	60⅞	61¼	60½	60⅜	. . .	59⅞	59
September,	55¼	54	. . .	54½	55⅝	58⅛	57⅞	59¼	57⅞	. . .	61⅝	63⅛	64⅛	67⅜	68½
October,	. . .	96¼	92½	96⅝	92¾	92⅜	93⅛	. . .	90⅛	93	94⅞	95½	95⅞	93⅛	. . .
November,	95½	96⅞	1 04½	1 19⅛	. . .	1 25⅛	. . .	1 14½	1 29¼	1 24⅞	1 26⅛	. . .	1 25⅞	1 27⅜	1 28¾
December,	1 10⅝	1 09¼	. . .	1 08⅞	1 04⅞	1 09½	1 15⅛	1 12½	1 11	. . .	1 09⅝	1 08½	93	92⅞	95½

FROM JANUARY 1, 1880, TO DECEMBER 31, 1892.

1880.

16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Average.
1 08⅝	1 07⅞	. . .	1 06	1 06	1 08½	1 07¼	1 07⅞	1 10⅜	. . .	1 11⅜	1 09	1 07½	1 08⅜	1 12½	1 .⅜	1 10¼
1 04⅜	1 03⅜	99⅝	97½	95½	95⅞	. . .	. . .	94⅝	92⅝	95½	97⅛	94	. . .	. . .	. . .	1 03
91½	80	87⅜	89⅜	89	. . .	89⅞	89⅝	89	88⅜	. . .	87⅜	. . .	87⅞	88½	88⅜	89½
74	74⅜	. . .	74⅛	72½	71⅜	71⅜	72¼	72½	72½	72⅛	72⅜	73⅜	74	74	. . .	77
. . .	81⅜	81	86⅜	85⅜	82⅞	81	. . .	. . .	87¾	91⅜	90½	91½	. . .	. . .	. . .	80⅝
94½	94⅛	96	1 04⅛	. . .	1 17⅛	1.18⅜	1 13⅜	82¾	1 08⅜	1 15⅞	. . .	1 13½	1 12¼	1 08½	. . .	1 00⅜
1 04⅛	1 01	. . .	97⅜	96½	91½	94⅝	96½	1 03⅜	. . .	91⅜	94⅜	97¼	97¼	94⅛	93½	1 01⅛
87⅛	89	88⅜	87¾	89	90⅞	. . .	96	94	87⅞	89⅛	91⅜	91	. . .	90⅞	90½	90¾
94⅜	96½	99	. . .	1 07⅞	1.01	99⅛	98½	91⅜	97⅞	. . .	99⅜	99⅜	99	1 00⅞	. . .	96
98⅜	. .	99¾	97⅞	97⅞	97⅞	.96⅜	96⅜	96⅜	95½	92¾	93⅜	93¾	95⅜	94⅜	. . .	96⅞
89¾	91	93½	91	91	. . .	92¾	94	94	. . .	90⅞	91½	. . .	92⅞	94⅛	. . .	91⅜
91⅜	92½	91⅜	. . .	92¼	92½	92⅛	91½	92⅛	. . .	. . .	92⅞	93⅛	96	97⅞	96	92¾

1881.

. . .	97⅛	97⅛	96½	95½	94	94	. . .	92⅜	91⅜	92⅞	93½	92⅞	92⅜	. . .	92¼	95
91	91	89¾	89⅛	. . .	90½	. . .	89⅜	89	87⅛	87⅛	. . .	86⅜	. . .	. . .	. . .	89¾
84⅜	84⅜	83½	81⅜	. . .	80⅞	80⅞	80⅞	77⅛	77¾	77¾	. . .	77⅞	81	79¾	79¾	85⅛
82⅞	. . .	79⅜	82⅛	82¾	82¾	84⅜	85¼	. . .	87½	87½	83½	83½	83½	83½	. . .	84¼
83⅛	81½	82⅛	82¾	82¾	84	. . .	84⅛	83½	82¼	83½	82⅞	82⅞	. . .	. . .	81½	81⅞
82¾	82⅛	82⅛	. . .	81⅜	80⅜	81	81	81	80⅜	. . .	79	78¾	77⅛	77⅜	. . .	81⅜
74	. . .	74⅛	72½	73½	74⅛	76⅜	75¾	. . .	78⅜	80½	77⅜	77¾	77¾	77¾	. . .	76¾
77⅞	78½	79⅛	82½	82½	. . .	79	79⅜	82⅛	81½	81⅞	82⅛	. . .	83½	86	86	79
93⅜	94	. . .	97⅝	98¾	97½	96⅞	93	93⅜	. . .	. . .	92⅜	93⅛	95⅝	93⅝	. . .	92⅝
. . .	95⅜	95⅜	94½	93⅞	94½	92½	. . .	91¾	90⅞	88⅜	88⅞	89½	88⅜	. . .	87	92⅝
82⅜	.81	.81½	.82	. . .	.83	.82⅜	81¾	. . .	.81	.80⅞	. . .	78⅛	77½	.79⅛	. . .	.82⅜
82¾	83⅜	. . .	84	82⅞	83	82⅞	83½	. . .	. . .	. . .	84	84⅞	83⅜	83	82⅜	83⅞

1882.

81⅜	83⅛	82⅛	84⅜	86⅛	85	. . .	83⅜	85⅜	85½	86⅜	86½	85¾	. . .	85	86¼	83¼
85¾	84⅞	84½	. . .	83½	82¾	. . .	80⅞	82	83¼	. . .	82¼	82	. . .	. . .	. . .	85¼
80¼	80½	80½	. . .	79⅛	79⅞	80	81⅝	82⅜	82½	. . .	83⅜	83½	82⅛	80½	80⅛	81
. . .	79⅜	79⅜	78⅜	78⅛	78½	78⅝	. . .	78½	77⅜	77⅜	76½	76⅜	75⅛	. . .	. . .	78⅞
73⅞	73⅝	71½	65⅝	68	. . .	66¾	63⅞	64¼	64¼	64	63⅛	. . .	60⅞	. . .	56⅛	69⅞
52⅜	52½	. . .	52¾	52¾	52⅞	53¾	53⅜	53	. . .	52⅜	52⅜	53½	52⅞	52⅞	. . .	54⅜
. . .	57⅛	57⅞	58⅜	57¾	58⅛	59⅞	. . .	62	62⅜	60⅞	57⅞	61⅜	62¾	. . .	61⅛	57¾
59⅜	59⅜	59⅛	58½	. . .	57½	57	56¾	57¼	55⅛	54⅞	. . .	56⅜	57⅛	56⅜	56	58⅝
74⅜	. . .	82⅜	77½	76¾	77⅞	82⅞	87¼	. . .	88¼	86½	84⅜	86⅜	89¾	95⅛	. . .	71⅞
92	93⅜	94⅜	93⅜	93⅜	93½	. . .	92⅜	91½	91⅜	92⅜	95⅜	95⅞	. . .	95¾	94⅜	93¾
1 25¾	1 15½	1 18	. . .	1 17¼	1 18⅜	1 13⅜	1 04⅞	96⅛	1 00¼	. . .	1 08¾	1 04½	1 10⅜	. . .	. . .	1 14⅜
93½	. . .	95⅜	84⅜	81½	85⅜	81⅛	78¾	. . .	. . .	75⅛	76½	78½	86¼	91¼	. . .	95½

[TABLE E.] DAILY PRICE OF PIPE LINE CERTIFICATES FROM

1883.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
January. . .	. . .	88¾	85½	85⅞	86⅞	88¼	. . .	88⅜	89⅛	90⅜	90	90⅛	90¼	. . .	91½
February. .	1 01⅞	1 02¼	1 01	. . .	1 01½	1 04¾	1 03⅝	1 03½	1 04⅛	1 02¼	. . .	98⅜	1 00⅜	98¾	99¼
March. . . .	98⅛	97	96⅛	. . .	96	93⅛	92	88⅛	89¼	93⅜	. . .	1 00⅜	99¾	98⅞	98⅞
April. . . .	. . .	94⅛	95⅜	94½	92⅞	91⅛	92	. . .	88¾	90	96½	96⅛	94¾	93⅞	. .
May.	92⅜	92⅝	92¾	92½	91½	. . .	92⅞	93	94⅜	93⅛	92¾	95	. . .	97⅜	1 01⅜
June.	1 19½	1 20	. . .	1 14½	1 11⅜	1 17⅜	1 17¼	1 15¾	1 18⅞	. . .	1 16⅛	1 16⅜	1 17¼	1 18⅜	1 19⅜
July.	. . .	1 16⅛	1 14⅜	. . .	1 14⅞	1 12¼	1 12¼	. . .	1 13¾	1 13½	1 12	1 11⅛	1 07⅛	1 05½	. . .
August. . .	1 05⅞	1 06⅜	1 08⅛	1 07⅜	. . .	1 10⅞	1 10⅛	1 10¼	1 10	1 10⅛	1 09⅜	. . .	1 08½	1 08½	1 11⅛
September. .	1 09⅛	. . .	1 08	1 07⅜	1 08¾	1 08⅜	1 07⅞	1 08½	. . .	1 10¼	1 13¾	1 14⅛	1 13	1 12⅛	1 14
October. . .	1 14⅜	1 13⅞	1 13⅜	1 14	1 13⅛	1 13½	. . .	1 11½	1 11⅞	1 09⅝	1 09½	1 10⅜	1 10	. . .	1 11⅛
November. .	1 09¼	1 09⅛	1 10⅜	. . .	1 09⅞	. . .	1 10	1 10	1 11⅞	1 13⅜	. . .	1 14⅜	1 15⅜	1 17½	1 18⅞
December. .	1 16¼	. . .	1 16⅝	1 15⅝	1 13¾	1 14	1 15¾	1 16⅝	. . .	1 15¾	1 14⅛	1 14¾	1 14	1 14⅛	1 13⅝

1884.

January. . .	. . .	1 14⅝	1 14⅜	1 14½	1 14⅜	. . .	1 15⅛	1 15	1 13⅞	1 13	1 11⅞	1 12⅜	. . .	09½	1 07⅝
February. .	1 09⅜	1 09⅜	. . .	1 09	1 10⅜	1 10⅛	1 09½	1 09⅛	1 09¼	. . .	1 09	1 08½	1 06	1 03¾	1 03⅜
March. . . .	1 05	. . .	1 04⅞	1 04	1 00⅛	99	1 00⅜	1 02	. . .	1 00⅜	1 01⅜	1 00¾	1 01¾	1 00⅜	1 00⅜
April. . . .	93	90¾	91⅛	93¼	93½	. . .	90⅛	92⅜	93⅝	93¼	. . .	95⅜	. . .	94⅜	94¼
May.	96⅜	99⅜	1 01¼	. . .	1 02	96⅞	96⅜	96¼	96	94⅝	. . .	93¾	92½	81⅝	73¾
June.	. .	78	76⅜	76⅛	75⅛	75¼	74	. . .	74	73¾	70⅜	71⅞	71½	72¼	. . .
July.	59⅜	61⅛	62	. . .	. . .	. . .	59⅝	60	60⅞	60	60⅜	60⅛	. . .	60⅛	63
August. . .	77	77	. . .	74½	77⅜	76⅜	80½	79	79⅜	. . .	78¼	78¼	78¼	77¼	76½
September. .	88⅞	89⅝	92	87⅜	86⅛	79⅜	. . .	76¾	77½	74½	74¼	75¼	78½	. . .	75⅜
October. . .	73¼	74⅛	74⅛	74⅝	. . .	74⅛	74¼	73⅜	73	72¾	70⅜	. . .	68⅞	62¾	62¼
November. .	71½	. .	72⅜	. . .	74⅜	73	73½	73½	. . .	72¼	73	72¾	70⅜	68¼	68⅞
December. .	78⅛	79⅛	78	78⅛	75½	72⅜	. . .	73⅜	73¼	72¼	71¾	72⅜	70⅞	. . .	72½

1885.

January. . .	. . .	75⅛	74⅞	. . .	73½	73¾	72¾	73⅛	72½	72⅝	. . .	71¼	70⅜	70⅞	69¾
February. .	. . .	69	69	69	69⅛	69¼	71½	. . .	71¼	70⅜	71⅛	70⅞	70⅛	70⅜	. . .
March. . . .	. . .	83	80⅞	79⅜	80¼	79	77⅛	. . .	77¾	79¾	80½	79⅜	77⅜	77½	. . .
April. . . .	81	81	. . .	. . .	79¼	78	78¼	77½	78⅜	78⅛	78⅛	. . .	79	78⅞	78⅜
May.	80	78⅞	. . .	78⅜	77½	78	77⅜	77⅜	78¼	. . .	78¼	78¾	78½	78⅞	78¼
June.	78⅜	78¼	79½	79½	79¼	79	. . .	79¼	79⅜	79⅜	79½	79¾	79⅜	. . .	75⅜
July.	92	90⅞	96½	. . .	. . .	98½	97¾	96⅞	95⅜	97½	95⅜	. . .	93⅜	96	95
August. . . .	98⅜	. . .	99⅜	98⅜	98⅜	99⅛	98½	. . .	. . .	98⅞	98	98¼	98½	1 00½	99¼
September. .	1 02⅜	1 00½	1 02½	1 02⅜	1 01	. . .	1 01½	1 01¾	1 00⅜	1 00½	1 01	1 01¼	. . .	1 00⅜	99⅜
October. . .	1 00⅞	1 00⅜	1 00½	. . .	1 01	1 00⅞	1 01⅛	1 01¾	1 01⅛	1 01⅛	. . .	1 01	1 00¾	1 01⅞	103
November. .	. . .	1 11	. . .	1 09⅜	1 08½	1 07⅞	1 08½	. . .	1 06¼	1 08⅛	1 07⅜	1 07½	1 07	1 07	. . .
December. .	88½	88¼	91¾	90	91⅜	. . .	91¾	90⅜	90⅜	90⅜	91¼	90⅝	. . .	90¾	91½

JANUARY 1, 1880, TO DECEMBER 31, 1892—*Continued.*

1883.

16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Average.
91⅞	91½	89¼	89⅝	89⅞	. . .	94⅛	93¼	99⅛	1 04⅞	1 03½	1 00⅞	. . .	97½	1 00	1 02½	92⅞
1 01⅝	1 00⅞	. . .	1 00⅞	1 00½	1 00½	. . .	99	98⅛	. . .	99¼	1 00½	98¾	. . .	. . .	. . .	1 01
1 01⅞	1 01⅜	. . .	1 06⅛	1 06⅛	1 04½	1 03	. . .	98¼	. . .	95	95¼	95	98½	94½	95⅝	97½
95⅝	94⅛	93⅜	94	94⅛	94½	. . .	92⅞	92⅞	90⅜	86⅞	88	87	. . .	89⅞	. . .	92½
1 02	1 01¼	1 02⅞	1 03	. . .	1 03⅜	1 03⅜	1 00¾	1 03½	1 03½	1 05⅞	. . .	1 08⅜	1 11	. . .	1 19⅜	99⅜
1 19½	. . .	1 16⅜	1 14½	1 15⅞	1 18⅜	1 16¼	1 15⅞	. . .	1 16	1 15⅜	1 15½	1 17¼	1 17⅜	1 16¾	. . .	1 16⅞
1 03½	1 03½	98⅞	1 00	1 04	1 05⅜	. . .	1 01⅞	1 03½	1 03	1 06	1 10½	1 07½	. . .	1 07⅞	1 08	1 07⅜
1 09	1 11⅛	1 10½	. . .	1 10⅛	1 08⅞	1 08	1 09⅜	1 08	1 06⅜	. . .	1 07	1 06¾	1 07½	1 07⅜	1 08½	1 08¾
. . .	1 15½	1 14½	1 14⅜	1 14⅜	1 16⅝	1 13⅜	. . .	1 13⅞	1 14⅜	1 16½	1 14⅞	1 15	1 15¾	. . .	. . .	1 12⅝
1 10⅜	1 10	1 10⅞	1 10	1 10⅛	. .	1 09⅜	1 09⅛	1 09⅛	1 11⅛	1 10⅜	1 10¾	. . .	1 10⅞	1 10⅛	1 09¾	1 11
1 17⅛	1 17⅛	. . .	1 16	1 18	1 17½	1 19½	1 18¾	1 17½	. . .	. . .	1 17⅜	1 16⅝	. . .	1 16¾	. .	1 14⅜
. . .	1 14	1 13	1 13⅜	1 13	1 13	1 14½	. . .	. . .	. . .	1 13½	1 13½	1 13½	1 13¾	. . .	1 13½	1 14½

1884.

1 09¾	1 07⅞	1 09⅝	1 08½	. . .	1 08⅝	1 08½	1 09¾	1 09⅜	1 10½	1 11⅛	. . .	1 10	1 10	1 12½	1 10⅜	1 11⅛
1 02	. . .	1 00⅜	1 02	1 00⅛	99½	. . .	1 00⅜	. . .	99⅝	99¾	1 00⅜	1 00⅜	1 02½	. . .	. . .	1 04¾
. . .	1 00⅜	1 00	1 00	1 00⅛	1 01	1 00¼	. . .	99⅜	99⅞	99⅝	96¼	94¼	94⅛	. . .	94⅝	1 00
97⅜	97⅛	97⅛	97	. . .	94	93⅛	92⅞	93¼	95⅛	94⅜	. . .	93¾	94	96⅜	. . .	94
77	79	. . .	77⅞	76⅛	74⅛	76	73⅜	73	. . .	74¾	79¼	77	77⅝	. . .	77¼	85⅛
71⅝	71⅜	70⅝	67	59⅛	55⅕	. . .	59¼	64¼	60⅛	62⅛	61½	62⅝	. . .	60¼	. . .	68½
64½	65⅛	63½	63	. . .	62¾	65	64½	64⅞	65½	. . .	63¾	67⅝	72	70⅛	73⅛	63¾
76⅝	. . .	76½	78¾	79⅛	82⅜	85½	85	. . .	89	89	88⅞	92¼	90⅞	90¼	. . .	81⅜
75⅛	77⅝	76⅛	76⅜	74⅜	. . .	71⅜	74⅛	74⅛	75½	73⅝	72	. . .	71	73⅜	. . .	77⅞
64	62⅛	61⅞	. . .	68⅞	72	72⅜	72½	76⅜	79½	. . .	73	68⅜	71⅜	72⅜	72	71
. . .	71⅞	71⅞	71½	71¾	71¾	72½	. . .	72⅜	71⅝	72½	. . .	75½	78¾	. . .	. . .	72½
72⅜	72⅞	73¼	76⅜	76⅜	. . .	75½	75⅛	75½	. . .	74	73	. . .	74⅜	74⅜	74⅛	74⅜

1885.

68⅝	70⅛	. . .	69⅞	69¾	69½	69	69⅛	69⅞	. . .	69¾	68⅝	69½	69⅜	69⅜	69½	70⅞
70¾	71¾	71⅞	72	74⅛	77½	. . .	. . .	77⅜	80⅛	82⅜	81½	81¼	. . .	. . .	. . .	73⅛
78½	79	80	82½	81⅛	80⅜	. . .	81½	83½	82⅞	82⅜	81¾	82⅛	. . .	81⅜	81	80⅜
78⅜	77⅝	77½	. . .	78¾	78⅛	77⅞	78⅜	78½	78¾	. . .	79¾	80½	80⅛	81	. . .	78⅝
79¾	. . .	79⅜	79½	79⅜	80	80	80⅜	. . .	80¾	80⅞	80½	80⅝	79⅜	. . .	. . .	79½
81⅛	80⅜	81½	81⅜	82⅜	. . .	82⅛	82½	84⅜	86½	87½	88½	. . .	92⅞	94	. . .	82½
95¼	94⅝	94⅝	. . .	93¾	93⅞	95½	1 00	1 01⅜	97⅝	. . .	98⅛	1 00⅛	99½	98¼	98⅜	96½
. . .	99⅛	99⅝	1 01½	1 01	1 04	1 02⅝	. . .	1 02⅞	1 01⅜	1 02⅜	1 03½	1 01⅞	1 02	. . .	1 01⅜	1 00⅜
1 00½	1 00	99⅜	99¾	. . .	1 00½	1 00	1 00⅜	1 00⅜	1 00	1 00½	. . .	1 01⅝	1 01⅜	1 01⅝	. . .	1 00⅜
1 07	1 07¼	. . .	1 08⅜	1 11⅜	1 11	1 09⅜	1 09	1 09⅝	. . .	1 08¼	1 10¼	1 10½	1 09⅜	1 10¼	1 11⅜	1 05½
1 07¼	1 10⅛	1 07⅜	1 07¼	1 04¾	99½	. . .	91⅞	95⅜	95¼	. . .	93⅜	93⅜	. . .	88⅜	. . .	1 04⅛
91	90⅜	90¼	88⅝	. . .	86⅛	87¼	88⅛	90¼	. . .	. . .	. . .	88	88⅝	87⅞	88¾	89⅝

[TABLE E.] DAILY PRICE OF PIPE LINE CERTIFICATES FROM

1886.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
January,	. . .	91⅛	. . .	90⅝	90	87⅜	89¼	88	87¾	. . .	87⅜	87⅜	87⅜	86½	87⅝
February,	82½	83¼	82⅝	82⅞	83	82½	. . .	79⅜	77⅜	75½	76	76¼	76⅞	. . .	79
March,	78⅝	79⅛	79	78¾	79⅜	79½	. . .	79¼	80	80	78½	77⅜	78	. . .	78½
April,	71½	71½	72	. . .	73¼	72⅜	72¾	72⅞	73	73½	. . .	76⅞	75⅞	76¾	75⅝
May,	73⅜	. . .	72¾	73⅛	73⅜	73¼	74⅛	73⅞	. . .	73⅜	73½	73¾	71⅜	72½	71⅞
June,	65⅛	65¼	64¾	65⅝	65	. . .	65	66⅜	65½	64⅞	66⅛	65¼	. . .	68¼	67¼
July,	66⅞	66	. . .	. . .	. . .	65⅜	65⅛	65½	64⅞	65	. . .	66⅛	66	65⅜	66⅝
August,	. . .	65½	65⅝	65⅝	63½	62¾	61⅞	. . .	62¼	61⅝	61¼	60½	60⅝	61½	. . .
September,	61⅜	61¾	61⅜	62	. . .	63	62⅜	62¼	63⅜	63⅛	62⅝	. . .	62⅜	63⅛	64½
October,	62½	62⅞	. . .	64⅜	63½	65⅞	64⅝	64⅜	65⅜	. . .	65⅛	65¼	64¾	64⅝	64⅝
November,	65¾	. . .	66	66⅜	65¼	65⅝	. . .	65¾	66	66⅝	67⅞	71⅜	74¼	. . .	74⅝
December,	79⅛	80½	81⅛	81	. . .	80¼	73	70	68⅜	68⅛	67⅝	. . .	69⅛	70	67¼

1887.

January,	. . .	. . .	70⅛	69¾	70⅞	71¾	70⅝	71	. . .	71⅝	71⅞	71¾	71⅝	70¾	71
February,	68⅝	67⅝	67¼	66¾	63⅝	. . .	63¼	62	63½	64	63¾	63½	. . .	62⅝	60⅞
March,	63⅞	62¼	62½	62⅞	63¼	. . .	63⅝	62	61¾	62⅞	63⅞	63	. . .	63⅛	63⅛
April,	63¼	63½	. . .	63⅜	65⅝	64⅛	64¼	. . .	65¾	. . .	64½	64⅜	64⅜	64½	64½
May,	. . .	66	66⅝	66	66⅝	66	66⅝	. .	66⅜	65⅝	64	64	63⅝	63¾	. . .
June,	62¾	62⅝	63⅛	63⅛	. . .	62¾	62⅜	62⅞	63⅛	63	63½	. . .	63⅜	62⅞	62⅝
July,	61¾	. . .	. . .	. . .	61	60⅜	61¼	60⅜	60⅞	. . .	60⅜	60⅝	60¼	60⅜	60
August,	57¾	57	57⅜	57½	57⅜	57⅜	. . .	57½	58⅞	59	59⅜	60⅝	62	. . .	60⅜
September,	65½	64⅜	64⅝	. . .	. . .	65⅞	67⅞	69½	69½	71	. . .	74½	68¼	62⅛	65
October,	69	. . .	67⅜	67⅞	68	68	68½	68⅝	. . .	69	71	70	71⅜	71	70⅛
November,	73	72⅜	72¾	73½	73½	. . .	73¼	. . .	72½	72¼	73⅝	73⅞	. . .	74½	73⅞
December,	75⅛	76	77	. . .	76⅜	76⅛	76⅜	76	77	76½	. . .	77⅛	77	77¼	77

1888.

January,	. . .	. . .	95⅜	92¾	94	93	94⅝	. . .	96⅞	95¾	95¼	96⅞	94	91⅝	. . .
February,	89¾	90	90½	90	. . .	89¼	90	90⅛	89⅞	90	89¾	. . .	88⅝	88⅝	88⅝
March,	94¼	93⅛	93⅝	. . .	93¾	98¼	97½	95⅜	94⅜	96⅛	. . .	95⅞	97¼	96¾	97½
April,	. . .	81⅛	79⅜	78½	75⅞	78¼	79¼	. . .	79⅛	77½	77⅞	79⅝	80½	82¼	. . .
May,	86⅛	86	86⅜	86⅜	86	. . .	84⅞	85¼	86¾	86⅛	86⅞	86¾	. . .	86¾	87⅞
June,	77⅜	79½	. . .	78⅛	79⅞	80⅜	78⅛	78⅞	78¼	. . .	76¼	77⅞	76½	77⅛	77⅝
July,	. . .	74	73¾	. . .	74⅜	76½	78⅝	. . .	79⅜	82⅜	82½	83⅛	83¼	82⅜	. . .
August,	82	83¼	83¾	84	. . .	86½	88¼	87¼	86⅞	86⅞	86⅞	. . .	85¼	82⅝	83⅛
September,	93⅜	. . .	. . .	94⅜	94⅝	92¾	96	96⅛	. . .	94¾	95½	95	93¼	92⅛	91¼
October,	95⅜	94⅞	95½	95⅛	93⅝	92¼	. . .	92⅜	92⅞	92½	93½	94⅜	94⅝	. . .	92⅜
November,	83¼	84⅛	85	. . .	85⅛	. . .	86⅜	85½	85½	85¼	. . .	86⅜	86⅜	85⅝	85½
December,	86⅝	. . .	86⅝	86⅝	86⅛	89⅛	88⅞	88¾	. . .	89⅛	89	89½	90½	92¼	92¼

JANUARY 1, 1880, TO DECEMBER 31, 1892—*Continued.*

1886.

16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Average.
87¾	. . .	87⅝	88⅝	88	88¼	88¼	89⅜	. . .	91⅜	89¾	89½	87⅞	83¾	82⅝	. . .	88⅜
79⅞	81⅜	80¼	78½	80⅜	. . .	. . .	79⅞	80⅝	79⅜	79¾	79⅛	. . .	. . .	. . .	. . .	80
78¾	78	77⅛	77	76⅞	. . .	76⅞	76¼	74	73½	73⅝	74⅜	. . .	73¾	71⅜	72⅝	77⅛
75⅜	77⅛	. . .	76⅛	76⅜	76⅛	76¼	. . .	72⅜	. . .	72⅜	72⅞	72⅞	72¼	73⅜	. . .	74⅛
. . .	71¼	67¾	68¼	67⅝	67⅞	67¼	. . .	63⅝	64¼	65½	64⅜	63½	63⅜	. . .	. . .	68½
67	67⅜	67¾	69⅞	. . .	69⅛	69	69½	68⅜	69	69	. . .	68½	67⅛	67⅜	. . .	67
66	66⅛	. . .	66⅜	67⅞	65⅜	65⅞	66	66⅜	. . .	66⅛	65⅞	65½	65⅜	66	65⅞	66
62½	61⅛	60½	61⅜	62⅜	63½	. . .	61	61	61	61¼	61⅜	61	. . .	61⅛	61⅝	62⅛
64⅜	64¼	65¼	. . .	64¾	64½	65	64¾	64¾	64¾	. . .	63	62⅜	62½	62⅜	. . .	63⅜
65⅜	. . .	66	66	65⅞	66	65	65¾	. . .	65⅜	65⅜	65⅞	66⅛	65¼	66⅛	. . .	65⅛
76½	75⅜	74⅞	75½	74½	. . .	77⅜	77½	76¼	. . .	77¾	78	. . .	77⅜	78¼	. . .	72½
69⅞	68⅞	69¼	. . .	68	66⅜	66¼	66⅝	67	. . .	. . .	66⅝	69⅝	68¼	69⅛	69½	71

1887.

. . .	71¾	72⅛	72½	71¾	71⅛	71⅜	. . .	70½	69¾	70⅝	70⅜	70	70¼	. . .	69½	71
61⅝	61¼	60⅝	61⅜	. . .	63	. . .	65¼	61¼	61⅞	61⅝	. . .	61⅝	. . .	. . .	. . .	63⅜
64¼	63¾	63¾	63¾	. . .	63½	63	62⅞	63⅛	63⅛	63⅝	. . .	63½	63⅜	63⅝	63⅝	63⅜
64½	. . .	63¼	63⅜	62⅞	63	63	63⅝	. . .	63¾	64⅛	65⅛	67⅜	68	66⅛	. . .	64½
63⅝	62⅛	62½	62½	61¾	62	. . .	62¼	62¼	62⅛	63¼	63⅞	63¼	. . .	. . .	63¼	64⅛
62⅞	62⅞	62⅞	. . .	63⅛	63	63⅛	62	61½	61⅝	. . .	61⅛	62	61⅞	61½	. . .	62⅝
60¼	. . .	60⅜	60	59⅞	59⅞	59¼	57⅛	. . .	56⅜	56⅛	54⅜	56¾	55⅞	56¼	. . .	59¼
61	61¼	61½	59	59⅜	. . .	61	61¾	61	61⅝	62¼	62⅜	. . .	62½	62	64½	61
64½	64⅛	. . .	65⅛	64½	66⅜	67½	68⅜	68⅛	. . .	68	67⅛	67⅜	67⅝	68⅝	. . .	67⅛
. . .	71⅜	72¼	74	73	74⅜	73¾	. . .	71⅜	70	70⅜	70	70¾	71	. . .	72⅞	70⅝
74⅜	74⅞	74⅝	74	. . .	74⅞	75	74⅞	. . .	74¾	74¾	. .	74⅛	74	74⅜	. . .	74
78⅜	79⅛	. . .	81¼	81	81¼	80⅞	82⅛	84⅛	. . .	. . .	88⅛	88½	87⅞	87¾	89¾	80

1888.

89⅝	86⅞	88⅝	90	91¼	92⅛	. . .	89	87⅛	88⅜	88⅝	88⅜	88⅞	. . .	89⅞	90¾	91½
87⅞	89¼	89¼	. . .	88⅜	87⅞	. . .	89⅜	89⅛	91⅜	. . .	93⅜	92½	93⅝	. . .	. . .	89⅞
97½	97½	. . .	96⅜	95⅞	93⅞	93½	88⅜	90½	. . .	90⅜	90⅛	85⅜	87⅝	. . .	85	93¾
86	88¼	87½	86⅝	84¼	86⅞	. . .	86⅛	84½	86⅜	85⅛	85⅞	85	. . .	86¾	. . .	82⅜
88⅞	89⅜	88⅞	89½	. . .	88⅞	86¾	85½	86⅝	86⅞	85⅞	. . .	85⅝	85⅝	. . .	82⅝	86⅜
76⅝	. . .	73	74	74⅛	73⅝	73½	72½	. . .	73⅜	72¼	72½	72⅞	73½	73	. . .	76
81	81⅛	81⅞	82⅞	84	83⅝	. . .	84⅜	83¼	82¼	81⅝	81	80⅛	. . .	80⅛	80⅞	77⅝
83½	85⅞	86⅛	. . .	88	87⅜	86⅝	87¼	87⅝	89⅝	. . .	89¾	91½	92⅛	90½	92⅝	86¾
. . .	94	94	94	92½	91⅞	91⅛	. . .	93⅞	92⅞	93¼	94¼	94⅜	95⅜	. . .	. . .	93⅜
92⅞	92⅜	92⅝	85¾	85	. . .	87	87⅝	87⅛	85¼	85⅞	85⅜	. . .	83½	84½	85¼	90⅝
85	85⅝	. . .	84⅝	86¼	85¾	85⅞	86⅛	86½	. . .	86¼	83⅜	85⅝	. . .	86⅞	. . .	85⅝
. . .	91⅞	91⅞	92⅞	93	88⅞	90	. . .	89⅞	. . .	88¾	87½	86½	87	. . .	87½	89¼

[TABLE E.] DAILY PRICE OF PIPE LINE CERTIFICATES FROM

1889.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
January. . .	. . .	88½	87⅞	86¼	86½	. . .	86	85⅞	86⅝	87¼	86½	86⅜	. . .	86⅛	85¼
February. .	85⅜	85¾	. . .	86⅛	86½	87⅛	87½	86¾	88⅛	. . .	88½	88⅞	89⅝	91⅝	91⅜
March. . . .	92¾	92½	. . .	92½	91½	90⅞	91¼	91	90⅝	. . .	91½	91⅜	89⅜	90¼	89⅞
April. . . .	90½	90⅞	91⅝	90½	90½	90½	. . .	90	90	90⅛	89¾	90	90⅛	. . .	90⅛
May, ...	. . .	86	85⅜	84⅜	. . .	82⅜	84¼	82⅞	82¼	82½	83	. . .	83¼	82⅞	81⅜
June. . . .	83¼	. . .	82⅞	82⅝	82¾	82½	83	82⅝	. . .	83½	84	83¾	83⅞	83⅝	93⅝
July. . . .	92½	92	91	. . .	90⅜	90⅞	. . .	90¼	90¾	92¼	92⅛	91⅞	91½	. . .	92
August. . .	99¾	99¼	99⅜	99⅜	99⅞	. . .	1 00	99⅜	1 00	1 00¼	. . .	99⅜	97⅜	97⅛	97
September, .	. . .	. . .	98	97½	96⅞	98⅝	99¼	. . .	99⅝	99	99	98¾	99½	1 00	. . .
October, . .	98⅞	98⅝	98⅛	98½	98⅞	. . .	98¼	98⅝	98½	98⅜	98⅞	99½	. . .	99¾	1 00¾
November, .	1 05¼	1 05⅜	. . .	1 05⅜	. . .	1 07⅛	1 09⅞	1 11½	1 09¾	. . .	1 08⅛	1 08⅛	1 10	1 09⅞	1 10
December, .	. . .	1 03⅜	1 04⅝	1 03⅝	102⅞	1 03⅜	1 03⅜	. . .	1 03¾	1 03¼	1 04⅛	1 03½	1 03⅝	1 04	. . .

1890.

January. . .	. . .	1 02⅝	1 03½	1 03½	. . .	1 02⅜	1 03	1 03⅛	1 03⅛	1 05¾	1 04⅞	. . .	1 04⅝	1 04⅜	1 04⅞
February, .	1 05½	. . .	1 05	1 05½	1 06⅞	1 06⅝	1 06¾	1 06⅝	. . .	1 06	1 06¼	1 06⅜	1 05⅞	1 06⅛	1 06¼
March. . . .	95⅝	. . .	94⅞	92¼	93⅛	93½	94⅝	95	. . .	93⅝	93	93⅞	91	89⅞	90⅝
April, ...	82	82¼	81½	. . .	81⅜	. . .	80⅛	80½	79¾	80⅝	80¼	81⅛	. . .	82¼	82⅝
May, ...	85½	85⅝	85⅝	. . .	85½	85	85	84⅞	84⅜	85¼	. . .	85⅞	86⅛	87	87½
June, . . .	. . .	89	87	85¼	87	86½	86⅝	. . .	89½	90	89	89½	89¼	89⅝	. . .
July, ...	86	89	89½	. . .	. . .	. . .	90	89½	88½	87⅝	88⅜	89	. . .	88⅜	88¾
August, . .	88¼	88⅝	. . .	88¾	89	89½	90¼	91⅞	92	. . .	91¼	90	90	92	91¾
September, .	. . .	82¼	82	82½	82¼	82	. . .	81	79½	80	80⅜	81½	82	. . .	83¾
October, . .	78¼	78	78	78	. . .	78⅝	79	79½	80¼	80⅝	80½	. . .	80½	81	81½
November, .	78½	. . .	78¾	. . .	80	78	78	76	. . .	74	74	73½	73	72¾	71½
December, .	67	66¼	66	68	67	66	. . .	65	65	65	64	65	65	. . .	65

1891.

January, . .	. . .	72½	72	. . .	73	75	73¾	76⅞	74	73⅝	. . .	74	74	74¼	74¼
February, .	. . .	77⅜	76⅛	76⅝	77¼	78¼	78½	. . .	80	79⅗	79⅜	80⅛	80	80	. . .
March, . . .	. . .	76¾	76¼	77	78⅛	76¼	76½	. . .	76⅜	76½	74½	73	73⅝	73⅖	. . .
April. . . .	72¾	73¼	73½	73	. . .	73⅜	73¼	73	74⅛	73	72⅔	. . .	73	73	72¾
May, ...	69½	71	. . .	72	71¼	71⅜	71½	72¼	72	. . .	71⅜	70½	70⅝	70¾	38
June, . . .	69	69½	69⅜	70	68¾	68¾	. . .	68½	68¼	68½	68½	69	69	. . .	68⅝
July, ...	66¼	66⅜	66¾	. . .	. . .	67½	68	67¼	67¾	68	68	. . .	68	68½	68½
August. . .	62	. . .	63¾	60½	60	58½	52	70	. . .	65	64½	66	69	70	69⅞
September, .	64¼	62	60	57½	57½	. . .	. . .	55	55⅞	55	55⅝	55½	. . .	56⅛	56½
October, . .	58⅝	60⅞	60	. . .	60¼	63½	62¾	61½	60⅝	60⅝	. . .	61½	62⅜	61⅝	60⅜
November, .	. . .	60	. . .	60	58⅜	57½	57⅝	. . .	57⅜	59	61⅛	60	59⅜	59⅜	. . .
December, .	60	60½	60⅛	59⅛	59	. . .	58⅞	59	58½	58¼	58½	59	. . .	59¾	59½

JANUARY 1, 1880, TO DECEMBER 31, 1892—*Continued.*

1889.

16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Average.
85½	84¼	83⅞	84	. . .	86½	86¾	84¾	85⅜	88	87	. . .	87	86⅞	85⅝	86½	86½
90	. . .	91½	90⅞	91⅞	90¾	. . .	91	. . .	92⅛	92¼	91⅛	91½	. . .	. . .	. . .	89½
89¼	. . .	89½	90⅛	91½	91	91¼	91½	. . .	92	91⅜	91½	91⅛	90⅜	90⅜	. . .	91
88⅜	84⅝	84¾	. . .	85½	. . .	82⅜	81⅝	82⅞	85½	85¼	84¾	. . .	. . .	. . .	. . .	87⅞
82⅛	80¾	81½	. . .	81½	82¼	83	83¾	84⅛	83⅞	. . .	84¾	84⅝	83⅞	. . .	82⅝	83½
. . .	84	83¾	83½	83¾	83½	83¾	. . .	89⅞	90	91⅝	92⅛	91⅜	92¼	. . .	. . .	83¼
92¼	93¼	95¼	94⅛	94⅜	. . .	97⅞	99½	1 01⅛	1 00¾	1 00½	1 00½	. . .	1 00¼	99¼	98⅜	96⅝
98⅜	99⅜	. . .	99⅞	99¼	98⅜	99¼	98½	97½	. . .	98	98	98⅜	98⅜	98⅛	98¼	98¾
99⅞	1 00¼	99⅞	99⅞	1 00	1 00	. . .	99¾	98¼	98⅞	90	98⅞	90	. . .	98⅝	. . .	99⅛
1 00¾	1 00⅛	1 00	99¼	. . .	1 00½	100⅜	1 02⅜	1 03¼	1 05⅜	1 05⅞	. . .	1 00⅜	1 06⅜	1 06¼	1 06	1 01⅛
1 10	. . .	1 09⅜	1 09⅜	1 10	1 09	1 09⅜	1 10	. . .	1 06⅞	1 06¼	1 04⅞	. . .	1 05¼	1 03¼	. . .	1 08⅛
1 04⅜	1 05	1 04⅞	1 03½	1 03⅞	1 03⅞	. . .	1 03¼	1 02½	. . .	1 03	1 03⅝	1 03¼	. . .	1 03¼	1 02⅝	1 03⅝

1890.

1 05¼	1 05½	1 05⅜	. . .	1 07¾	1 07⅝	1 07¼	1 06¼	1 06½	1 06⅞	. . .	1 06⅜	1 06½	1 05⅜	1 04¾	1 05¼	1 05
. . .	1 05⅜	1 05⅜	1 04⅜	1 04⅜	1 05⅜	. . .	. . .	1 04⅞	1 04⅞	1 00⅛	99⅜	99¼	. . .	. . .	. . .	1 05
. . .	88¼	88	89	86½	87⅜	87½	. . .	84⅜	84½	84⅞	85⅜	84⅞	85	. . .	84	89¾
82⅞	84⅜	84⅝	85⅛	. . .	83⅜	82⅝	83¼	84¼	84⅝	84⅜	. . .	84	84½	84¾	. . .	82¾
87¼	89¼	. . .	94⅛	95	93½	92	94	94½	. . .	93⅞	92¼	90½	89½	. . .	90	88⅜
89½	89⅜	89	89¾	89	89½	. . .	88¼	88½	88⅞	87¼	86½	85½	. . .	85⅞	. . .	88⅜
88¼	88½	89½	90	. . .	89⅝	89	89	88½	88⅜	89⅛	. . .	88⅞	88¾	89	87¾	88¾
92	. . .	91½	90¾	87⅞	85½	85⅜	86	. . .	86⅜	85¼	84½	84	83½	83	. . .	88⅝
81¾	81¾	81⅜	81½	80¼	. . .	80	79½	79⅞	80¼	80	79⅝	. . .	80½	78½	. . .	81⅛
81½	81½	82¾	. . .	82½	80¾	80½	81	80	80	. . .	80	79	77¾	76	78¼	79¼
. . .	71	70	68½	69	68¾	69	. . .	70	69¾	68	. . .	67¾	66	. .	. . .	72¾
64½	64½	64½	71½	68⅜	. . .	69½	68¾	69	. . .	70	70⅜	. . .	72	71	70½	67¾

1891.

74	73⅜	. . .	74	74	74	77	77½	77	. . .	76	74	74	74½	75	76	74
79⅝	78½	77½	76⅝	76⅜	76½	. . .	. . .	76	75¾	75⅜	76	76	. . .	. . .	. . .	77¾
73⅝	73½	72	72⅜	71⅜	71⅜	. . .	72½	72⅝	72½	73	. . .	72⅜	. . .	72¾	72½	74⅜
71	70⅜	70	. . .	68¾	68⅜	68⅝	69	69	. . .	. . .	69	67¾	66⅞	66¾	. . .	71½
68¾	. . .	68	68½	68½	68⅝	68⅝	68⅝	. . .	67¾	68½	68½	68½	68	. . .	. . .	69⅜
68⅝	68½	67½	67½	67¼	. . .	68½	66⅞	66¼	66⅜	66½	66¾	. . .	66	65⅜	. . .	67½
67⅞	67½	67⅛	. . .	67⅜	67½	67¾	68	67⅞	67¼	. . .	64	62¾	63	60	60	66⅜
. . .	64	66½	65⅜	64½	63¾	64⅜	. . .	64½	64⅝	64½	63½	63	62¾	. . .	62½	64⅝
56½	57½	59	60¾	. . .	58⅞	59⅝	62½	61	60¾	60	. . .	58½	57	56½	. . .	58⅜
61⅛	61⅞	. . .	60⅞	60⅜	59½	59⅞	60⅝	60⅝	. . .	60⅛	60½	59¾	59½	58⅞	59½	60⅜
59⅜	60	59¼	59½	59⅛	58⅞	. . .	59¼	59⅜	58⅞	. . .	58	57⅞	. . .	58	. . .	59
58⅞	58⅞	59½	60	. . .	59⅝	58⅞	59⅝	59½	. . .	. . .	. . .	59¾	59	59	59¼	59½

[TABLE E.] DAILY PRICE OF PIPE LINE CERTIFICATES FROM 1892.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
January, . .	. . .	61⅜	. . .	62⅛	61⅜	61⅜	61⅛	62⅜	63⅛	. . .	63½	63¾	63⅛	63	62⅞
February, .	63⅜	61¾	61½	60⅝	59⅞	60⅛	. . .	60⅛	60⅛	59⅝	59¾	59⅞	60⅛	. . .	59⅞
March, . . .	59⅜	59⅛	59⅛	59⅛	59⅜	. . .	59⅜	60	59¾	59⅜	59½	59½	. . .	59⅛	58⅜
April, ...	56⅜	57¾	. . .	57¼	57¾	56¾	56⅜	56¾	57⅝	. . .	58	58	58	57½	. . .
May, ...	. . .	58	58¼	57⅝	57⅝	57⅜	57	. . .	57	57¼	57½	57⅜	57	56⅞	. . .
June, ...	56¾	54¼	53¾	54⅝	. . .	54⅞	55	54½	54¾	54½	54¾	. . .	55	55	54⅞
July, ...	53⅜	. . .	. . .	. . .	53⅛	53	52⅞	52⅞	52⅞	. . .	53⅛	53	52⅝	52¾	52¾
August, . .	52	52	52⅛	52⅜	51⅜	53½	. . .	53	55	55¾	56⅞	57	57⅝	. . .	57¾
September, .	55⅜	55⅛	55⅛	. . .	55⅜	55⅜	55⅜	55⅝	55¾	55⅜	. . .	55⅜	55	54⅜	53¾
October, . .	53	. . .	52⅛	51½	51⅝	52	51⅝	51¾	. . .	52¾	52	. . .	52	52⅛	51⅞
November, .	51¼	51⅝	52	52⅛	51⅞	. . .	51⅞	. . .	52⅛	51⅞	51¾	51¾	. . .	51¾	52⅞
December, .	52⅜	53½	53½	. . .	53⅜	53⅜	53¾	53¾	53¾	54⅝	. . .	54⅝	54⅝	54⅝	54⅝

January 1, 1880, to December 31, 1892—*Continued.*

1892.

16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Average.
63⅛	. . .	62⅝	62⅛	62⅛	62¾	63	63	. . .	62⅛	62¼	62¼	62	62⅛	62	. . .	62½
60	60⅛	60⅝	60⅜	60¾	. . .	. . .	59⅝	58½	58⅞	58⅞	57¾	. . .	58¼	. . .	. . .	60
57½	56¾	56⅜	56⅝	. . .	57	55⅞	53⅞	53½	54⅜	55¼	. . .	55	55⅛	55	55	56⅜
58⅜	. . .	59⅜	59½	59	59¼	59⅛	58⅜	. . .	57⅞	57⅛	56½	56¾	56⅝	56½	. . .	57½
56¾	57⅛	56½	56	55½	56½	. . .	57⅛	57	56½	56⅜	56⅛	55¾	. . .	56	56⅛	56¼
55	55	54⅜	. . .	54	53⅝	53½	53¼	52⅞	52⅜	. . .	53	52⅞	52⅞	53	. . .	54⅜
52½	. . .	52⅝	52	51½	52	52½	52¾	. . .	52⅞	52½	51¾	51⅝	51⅜	51⅝	. . .	52⅜
56¼	55⅞	56½	55⅜	55	. . .	55⅛	55⅞	56¼	55⅜	55⅜	55½	. . .	55	55⅜	55⅛	55⅜
54	54¼	. . .	53⅛	53½	53¾	54⅜	54¾	54½	. . .	54⅝	54⅛	54	53	53¼	. . .	54⅛
. . .	51	50¾	51	50⅞	. . .	. . .	. . .	51½	50⅜	51	50⅝	50¼	50½	. . .	50⅛	51½
52⅜	52⅞	52⅛	52⅛	. . .	52⅜	53	51⅞	. . .	. . .	. . .	. . .	51	. . .	50⅜	. . .	52
53	53	. . .	53	53	52¼	52⅝	52⅝	52⅝	. . .	. . .	52⅚	53	53	53	52⅛	53⅛

[TABLE F.] AVERAGE MONTHLY AND YEARLY PRICES OF PIPE

YEARS.	January.	February.	March	April.	May.	June.
1865, ...	$8 25	$7 50	$6 00	$6 00	$7 37½	$5 62½
1866.	4 50	4 40	3 75	3 95	4 59	3 87½
1867.	1 87½	1 85	1 75	2 07½	2 35	1 90
1868, ...	1 95	2 00	2 55	2 82½	3 75	4 50
1869, ...	5 75	6 95	6 00	6 70	5 35	4 95
1870.	4 52½	4 52½	4 45	4 22	4 40	4 17½
1871, ...	4 03	4 48	4 25	3 96	4 64	5 02
1872, ...	4 00	3 81	3 63	3 51	4 00	3 99
1873, ...	2 36	2 10	2 12	2 33	2 54	2 10
1874, ...	1 34	1 96	1 72	1 95	1 51	1 12
1875, ...	1 08	1 50	1 64	1 42	1 14	1 12
1876, ...	1 74	2 03	2 04	1 90	1 87	2 03
1877, ...	3 53	2 69	2 68	2 60	2 23	1 94
1878.	1 42	1 64	1 59	1 36	1 35	1 13
1879, ...	1 02	98	86	87	75	67
1880, ...	1 10½	1 03	89½	77	80⅛	1 00⅝
1881, ...	95	89¾	83⅛	84⅛	81¾	81⅝
1882, ...	83½	85½	81	78⅜	69⅞	54¾
1883, ...	92⅞	1 01	97½	92½	99⅝	1 16⅞
1884.	1 11½	1 04¾	1 00	94	85⅛	68½
1885.	70⅞	73⅛	80⅝	78⅞	79¼	82¼
1886, ...	88⅝	80	77⅛	74⅛	68½	67
1887, ...	71	63⅜	63⅜	64½	64⅛	62⅜
1888, ...	91½	89⅞	93¾	82⅜	86¾	76
1889.	86¼	89¼	91	87⅞	83⅛	83¼
1890, ...	1 05	1 05	89¾	82¼	88⅝	88⅜
1891, ...	74	77¾	74⅜	71⅞	69⅜	67½
1892, ...	62½	60	56⅜	57½	56¾	54⅜

Line Certificates from January, 1865, to December, 1892.

July.	August.	September	October.	November.	December.	Yearly.
$5 12½	$4 62½	$6 75	$8 12½	$7 25	$6 50	$6 59
3 00	3 75	4 50	3 39	3 10	2 12½	3 74
2 62½	3 15	3 40	3 55	2 50	1 87½	2 41
5 12½	4 57½	4 00	4 12½	3 75	4 35	3 62½
5 37½	5 57½	5 50	5 50	5 80	5 12½	5 63¾
3 77½	3 15	3 25	3 27½	3 22	3 40	3 84
4 84	4 67	4 74	4 80	4 19	4 10	4 47
3 66	3 35	3 28	3 15	4 57	3 43	3 95
1 85	1 32	1 15	1 04	1 25	99	1 73
1 06	1 04	76	68	51	59	1 18
85	89	1 30	1 34	1 21	1 41	1 25
2 23	2 90	3 87	3 39	3 35	3 79	2 51
2 17	2 41	2 40	2 28	1 91	1 82	2 39
99	1 00	80	82	85	95	1 16
69	67	69	87	1 04	1 18	88
1 01⅛	90⅜	96	96⅞	91⅜	92¼	94⅛
76⅜	79	92⅝	92⅝	82⅝	85¼	85¼
57⅜	58⅛	71⅜	93¾	1 14⅜	95½	78⅛
1 07⅞	1 08¾	1 12⅝	1 11	1 14⅞	1 14½	1 06¾
63¾	81⅜	77⅞	71	72½	74⅛	83⅝
96½	1 00⅜	1 00¾	1 05½	1 04⅛	89⅜	88½
66	62⅛	63⅜	65⅛	72½	71	71¼
59½	61	67⅛	70⅜	74	80	66⅛
77⅜	86¾	93⅝	90⅜	85⅜	89½	87
96⅜	98¾	99⅛	1 01½	1 08½	1 03⅜	94
88¾	88⅜	81½	79⅜	72⅜	67⅞	86½
66⅜	64½	58½	60⅜	59	59½	66¾
52⅜	55⅜	54⅛	51½	52	53⅛	55⅛

[TABLE G.]

PRODUCTION OF CRUDE PETROLEUM IN THE PENNSYLVANIA FIELDS, BY DISTRICTS, DURING THE YEAR 1888.

DISTRICTS.	Production (barrels of 42 gallons each).
Bradford and Allegany,	6,284,374.85
Forest,	204,250.37
Warren,	1,865,366.19
Butler,	3,478,387.29
Bald Ridge,	1,220,054.02
Tidioute,	660,327.87
Washington,	2,322,189.73
Greene,	9,527.54
Mount Morris,	79,278.96
Nineveh,	4,227.36
Shannopin,	301,906.04
Brush Creek,	54,778.03
Total,	16,484,668.25

[TABLE H.]

PRODUCTION OF CRUDE PETROLEUM IN THE PENNSYLVANIA FIELDS, BY DISTRICTS, EACH MONTH DURING THE YEAR 1889.

(Barrels of 42 gallons.)

	January	February.	March.	April.	May.	June.	July.	August.	September.	October	November.	December.	Total.
Bradford district, Pennsylvania and New York, and Allegany county, New York.	603.946	490,878	607,804	548,903	595.371	614,286	638.763	628.792	586,686	618.286	598.952	625.696	7.158.363
Forest county,	19 537	16,737	21,689	19,393	23.699	22.647	23,673	22,336	21,823	22,432	23.132	21.857	258.955
Warren county.	174,437	162,844	190,188	201,159	209.474	202.385	211.600	201.766	191.843	206.944	195,290	199.504	2.347.434
Butler and Clarion counties, etc.,	412.733	352,432	405,950	406.797	432.769	413,407	451.064	490.873	475,925	502,541	484,772	529.140	5.358.403
Tidioute and Titusville.	66,569	61,135	70.321	67,122	83,560	72,476	77,392	75,450	68,728	78,365	80.920	83.081	885,119
Allegheny county.	20.495	22,599	28.996	32.625	50,598	55.214	56,529	54.387	49.942	59.086	49.606	61.015	541.092
Beaver county.	27.361	23.230	28.159	28.092	45,796	41.071	51,675	49.354	49.545	57,670	78.007	122.776	602.736
Washington county.	185,516	171.165	244.474	301.799	349.192	357.033	401,325	397.093	376.007	363.830	351.509	349,202	3.848.145
Greene county.	24.707	23.873	22.383	21.836	23.527	24.792	33.819	36.767	38.768	42.719	44.176	55.545	392.912
Franklin district.	5,088	5.172	6.280	5.790	5.373	5.757	5.911	4,992	5,927	4,880	5,091	5.015	65.276
Smith s Ferry district.	2.417	2.417	2.417	2.417	2.417	2.417	2,417	2.417	2.416	2.416	2.416	2,416	29.000
Total.	1.542.806	1.332,482	1.628,661	1.635,933	1.821,776	1.811.485	1.954.168	1.984.227	1.867.610	1,959.169	1.913,871	2,055.247	21.487.435

[TABLE I.]

PRODUCTION OF CRUDE PETROLEUM IN THE PENNSYLVANIA FIELDS, BY DISTRICTS, EACH MONTH DURING THE YEAR 1890.

(Barrels of 42 gallons.)

DISTRICT.	January.	February.	March.	April	May.	June.	July.	August	September.	October	November.	December.	Total.
Allegany, N. Y., ...	98,611	94,470	109,045	100,075	111,562	103,754	110,346	99,854	98,886	102,499	96,123	94,238	1,219,463
Bradford, Pa., ...	535,653	484,212	531,827	534,888	557,380	533,281	549,993	520,410	514,647	516,656	488,132	502,648	6,269,727
Middle District, ...	144,213	173,704	233,291	193,004	145,348	147,077	145,629	141,850	140,519	141,552	130,818	132,916	1,869,921
Clarendon.	11,296	17,572	18,264	17,092	25,940	20,358	25,474	21,476	19,182	36,910	27,505	25,383	266,452
Tiona. , ...	66,184	62,562	61,112	61,086	58,988	60,229	52,253	53,737	46,643	54,422	46,167	44,545	667,928
Tidioute and Titusville,	64,620	61,084	63,299	69,191	68,029	67,673	69,094	72,152	73,092	77,289	74,924	76,541	836,988
Grand Valley, ...	18,723	15,840	16,807	20,560	19,832	19,390	21,608	19,706	20,981	21,359	19,689	18,585	233,080
Tarkill and Egypt. . . .	92,585	89,446	96,010	100,169	105,792	104,791	112,456	105,844	108,798	111,434	90,488	105,481	1,232,294
Second Sand, ...	16,057	14,657	16,914	21,517	17,939	23,036	21,466	17,537	20,323	17,985	19,363	18,793	225,587
Halliday Run.	3,992	4,191	4,247	3,978	5,694	5,149	6,361	5,551	6,093	6,244	5,542	6,384	63,426
Bullion.	7,346	7,058	6,951	11,323	12,018	13,562	24,826	31,819	24,468	20,188	15,339	14,265	189,163
Lower District.	428,824	402,820	454,041	464,715	516,531	517,016	564,596	582,289	589,486	653,222	600,206	598,738	6,372,484
Washington county, . .	363,589	330,550	373,388	363,480	376,026	251,060	337,448	319,750	299,504	283,545	254,945	247,202	3,900,487
Beaver county, ...	126,314	144,832	164,468	138,833	122,159	117,536	118,357	116,697	108,494	110,103	92,189	88,157	1,448,139
Greene county.	59,194	65,359	60,577	56,852	58,096	56,213	61,468	79,371	99,309	119,483	116,545	123,563	956,030
Allegheny county, . . .	58,259	54,089	76,046	123,928	129,959	175,524	228,861	246,104	304,719	400,459	430,450	478,642	2,707,039
West Virginia.	38,644	38,061	44,842	39,804	39,160	35,610	34,096	31,505	50,342	46,387	45,062	49,065	492,578
Eastern Ohio, ...	. . . . .	925	422	442	721	975	648	387	637	419	554	617	6,747
Macksburg, O., ...	36,713	40,712	53,193	60,729	80,167	98,268	118,182	132,173	140,634	130,224	113,664	95,675	1,108,334
Total.	2,170,817	2,102,144	2,384,744	2,381,666	2,451,341	2,450,502	2,603,161	2,598,212	2,666,757	2,858,380	2,676,705	2,721,438	30,065,867

[TABLE J.]

PRODUCTION OF CRUDE PETROLEUM IN THE PENNSYLVANIA FIELDS, BY DISTRICTS, EACH MONTH DURING THE YEAR 1891.

(Barrels of 42 gallons.)

DISTRICT	January.	February.	March.	April.	May.	June.	July.	August.	September.	October	November.	December.	Total
Allegany, N. Y.	106,951	85,457	98,886	100,211	93,065	100,897	96,655	93,349	89,720	88,658	75,230	92,495	1,121,574
Bradford, Pa.,	518,674	439,831	478,498	478,242	460,652	468,375	456,516	449,891	429,207	429,358	396,275	446,899	5,452,418
Middle District,	139,911	118,239	135,376	124,195	138,935	139,103	139,880	132,782	125,780	120,667	106,598	115,140	1,556,606
Clarendon and Warren,	32,424	39,123	39,146	30,375	34,650	23,213	14,833	25,183	20,378	34,471	32,526	33,905	360,227
Tiona,	48,116	41,822	45,979	52,006	56,816	44,743	40,915	50,345	40,735	46,015	39,452	46,786	553,730
Tidioute and Titusville,	78,588	67,629	73,770	69,941	66,788	71,719	72,170	69,919	69,122	68,831	65,573	63,237	837,287
Grand Valley,	19,669	16,006	18,971	17,163	17,527	17,118	17,125	16,690	15,901	15,883	13,721	13,230	198,954
Tarkill and Egypt,	107,599	94,186	97,435	99,258	90,263	96,302	95,028	92,234	95,970	.....	.....	.....	868,275
Second Sand,	20,116	19,149	20,288	22,857	21,232	21,979	21,034	22,297	20,764	29,711	22,324	27,104	268,855
Halliday Run,	5,770	4,854	5,537	5,521	6,059	5,040	5,514	4,836	4,420	.....	.....	.....	47,551
Bullion,	13,970	12,860	15,031	13,388	11,908	12,552	12,828	12,013	12,913	.....	.....	.....	117,463
Lower District,	628,755	526,323	544,578	542,459	538,458	546,028	544,040	550,287	551,902	651,837	616,671	711,201	6,952,539
Washington county,	241,395	201,059	221,400	210,760	208,452	208,756	254,040	261,721	320,652	298,187	279,024	291,832	2,997,278
Beaver county,	87,930	80,081	81,691	91,518	79,371	88,942	80,695	86,008	74,826	68,745	61,800	61,616	943,223
Greene county,	161,394	78,976	7,024	8,799	10,119	12,332	14,838	7,380	10,069	11,585	9,182	10,115	341,813
Allegheny county,	609,722	454,111	469,385	462,438	446,359	451,372	415,057	591,411	946,609	1,704,724	2,108,747	1,657,325	10,317,258
West Virginia,	48,736	125,675	229,800	225,853	231,909	223,567	220,960	238,284	219,361	219,909	207,310	214,854	2,404,218
Eastern Ohio,	397	648	1,359	919	255	1,087	965	1,175	2,726	619	4,257	8,452	22,859
Macksburg, O.,	88,664	39,972	26,938	28,442	28,680	23,927	29,606	27,653	28,865	26,917	24,171	26,189	400,024
Total,	2,958,781	2,444,001	2,611,092	2,584,345	2,541,496	2,557,052	2,532,699	2,733,458	3,079,920	3,816,067	4,062,861	3,820,380	35,742,152

[TABLE K.]

PRODUCTION OF CRUDE PETROLEUM IN THE PENNSYLVANIA FIELDS, BY DISTRICTS, EACH MONTH DURING THE YEAR, 1892.

(Barrels of 42 gallons.)

DISTRICTS	January.	February.	March.	April.	May.	June	July.	August.	September.	October.	November	December	Total.
Allegany, N. Y.	73,244	83,918	80,473	83,012	82,829	83 047	77,744	75,944	72,617	65,335	63,552	66,888	908,603
Bradford, Pa.	359,127	394,788	385,150	382,649	376,997	380,987	352,414	356,131	333,255	320,654	321,652	327,257	4,291,061
Middle District.	100,168	99,303	104,574	95,378	101,516	94,878	92,759	93,210	84,375	85,637	81,965	111,557	1,145,320
Clarendon and Warren.	21,074	21,264	26,099	21,160	19,111	31,768	19,438	27,498	21,260	28,598	16,080	19,173	272,523
Tiona.	41,728	41,705	39,677	47,710	45,952	36,376	36,851	36,013	33,821	34,595	32,761	48,529	475,708
Tidioute and Titusville,	55,066	59,723	54,118	60,940	58,791	56,479	55,165	53,517	50,270	51,709	48,149	25,237	629,164
Grand Valley.	11,085	13,239	10,436	11,953	11,265	11,624	11,186	11,574	9,642	10,637	10,460	5,000	128,101
Second Sand,	21,564	24,996	24,858	26,255	22,082	25,059	23,860	23,075	22,253	18,583	19,257	20,189	272,011
Lower District.	641,576	626,499	644,968	605,061	612,637	577,539	574,629	574,949	526,986	508,970	476,070	467,819	6,837,703
Washington county.	257,530	228,483	216,826	216,732	211,610	207,294	203,984	198,345	189,060	169,887	178,393	174,244	2,452,388
Beaver county,	60,233	53,203	60,627	55,809	52,977	54,382	50,129	52,278	49,560	46,478	44,342	43,354	623,372
Greene county,	8,906	10,437	10,526	8,933	8,394	9,432	6,827	8,941	7,127	7,658	7,486	7,441	102,108
Allegheny county, Pa.,	1,128,801	1,038,420	991,822	951,152	873,835	861,912	849,225	809,892	718,749	716,073	641,803	615,172	10,196,856
West Virginia.	195,262	186,205	185,218	181,458	205,892	261,650	328,235	410,864	420,632	450,907	467,196	513,567	3,807,086
Eastern Ohio.	7,948	8,425	17,741	21,281	23,230	32,853	44,649	88,175	151,543	206,005	188,391	202,505	992,746
Macksburg, Ohio.	25,814	24,469	24,630	24,158	27,177	23,077	25,029	23,202	.....	.....	.....	.....	197,556
Total.	3,009,126	2,915,077	2,877,713	2,793,641	2,734,294	2,748,357	2,752,124	2,843,609	2,691,150	2,721,726	2,597,557	2,647,932	33,332,306

[TABLE L.]

TOTAL PRODUCTION OF CRUDE PETROLEUM IN THE PENNSYLVANIA FIELDS, BY MONTHS, FROM JANUARY, 1871, TO DECEMBER, 1892.

(Barrels of 42 gallons.)

	January	February	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
1871.	418,407	372,568	400.324	385.980	408.797	410.540	456.475	462,582	461,940	485.243	464.610	477.958	5,205,234
1872.	583,575	462.985	461.590	462.090	537.106	491,130	517,762	549.909	500.430	442,432	638.610	645.575	6.293.194
1873.	632.617	608.300	665.291	641.520	776,564	795.470	867,473	936.138	954.270	942.493	991,470	1,084,380	9.893,786
1874.	1,167,243	835.492	883.438	778,740	895,745	921,750	1.033.447	931.519	840.630	919.739	861.060	858,142	10.926.945
1875.	852.159	719,824	789,539	675.060	696,508	696.210	788,361	718,766	698.940	731.073	700,200	720.874	8,787,514
1876.	712,225	668.885	718.177	701.490	755.351	725.600	765.623	782,223	780.600	809,162	786,480	787.090	8.968.906
1877.	842.890	783,216	901,697	972,810	1.127,594	1.130.790	1,189,005	1,275.759	1,214,910	1,269.326	1.173.420	1.256,058	13,135.475
1878.	1.203.296	1,094,856	1.208.380	1,195.890	1,264,862	1.217.250	1,283,865	1.541,928	1.315.710	1,369,797	1.348.950	1.318.678	15.163,462
1879.	1.369.921	1.261,935	1.499.315	1.530.450	1.644,922	1.675.650	1.637,767	1.892,302	1.856,700	1,836.378	1.710,480	1.769,356	19,685.176
1880.	1.904.113	1.870.008	2.015,992	2.015,700	2.228,931	2.158.440	2.248.430	2,341,027	2.346,300	2.385.636	2.274,420	2.238,634	26,027.631
1881.	2,244,090	1,913.128	9.274.532	2.205.780	2.395.293	2.577.860	2,372,678	2,331,727	2,193,420	2.323.171	2,266.830	2.480.000	27,376.509
1882.	2.353.551	2.151.332	2.482.170	2.402.790	2.486.572	2.825.940	3,258,162	3.104,495	2.620,380	2.297.658	2.192,940	1.897,510	30.053.500
1883.	1.948 319	1.756,188	1.830.674	1.816,530	1,962,052	1.977.900	2,020.394	1.879.437	1,913.370	2.076 659	1,958.340	1 988.526	23,128.389
1884.	1.825,838	1.880.650	2.052,262	2,065.860	2,381,854	1.862,190	2.059,950	2.099,165	1.948.260	1.961,866	1.811,700	1.822,614	23.772.209
1885.	1.652.176	1,437.884	1.638.133	1.780,290	1.771,371	1,767,210	1,775.804	1.705,961	1,712.790	1.871,105	1.761,660	1.898.657	20,776.041
1886.	1.748.958	1,604.848	1.928.448	1.938.360	2.178.773	2.335.380	2,418.961	2.413,206	2,418.540	2.408.111	2.222,790	2 181,625	25.798,000
1887.	1.990.851	1.827.924	2,007.196	1.960.860	1,993,517	1.912.860	1,899.525	1,848.877	1,779.930	1.843,291	1.125.450	1.288.602	21.478.883
1888.	1,155.937	1,290.718	1,338.877	1,349.403	1,473,362	1.450.703	1.394.847	1,382.077	1,273.080	1.354,518	1.442,405	1.582.741	16.488.668
1889.	1,542.806	1.332.482	1.628.661	1.635,933	1.821,776	1,811,485	1.954,168	1.964,227	1,867.610	1.959.169	1.913.871	2.055.247	21.487.435
1890.	2.170.817	2.102,144	2.384.744	2.381.666	2.451.341	2,450.502	2.603.161	2,598.212	2,666,757	2.858.380	2 676.705	2.721.438	30.065.867
1891.	2.958.781	2.444.001	2.611,092	2.584.345	2.541,496	2,557.052	2,532.699	2.733.458	3,079.920	3.816,067	4.062.861	3,820,380	35.742.152
1892.	3.009.126	2.915.077	2.877.713	2,793,641	2,734.294	2.748,357	2,752.124	2.843.609	2.691,150	2.721.726	2,597,557	2.647.932	33,332.306

[TABLE M.]

PRODUCTION OF CRUDE PETROLEUM IN THE PENNSYLVANIA FIELDS, BY DISTRICTS, EACH YEAR UP TO DECEMBER 31, 1880, AS CLASSIFIED BY PROFESSOR S. F. PECKHAM, FOR THE TENTH UNITED STATES CENSUS REPORT.

YEARS.	Oil Creek division.	Pithole district.	Central Allegheny division.	Lower Allegheny division.	Tidioute district.	Clarion division.	Bradford division.	Bullion district.	Warren division.	Beaver division.	Yearly total of all districts
Total.	35,517,217	4,816,298	6,482,900	37,342,978	4,674,345	20,381,638	44,574,921	2,312,190	448,213	339,631	156,890,331
1859,	2,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	2,000
1860,	500,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	500,000
1861,	2,113,609	.....	.....	.....	.....	.....	.....	.....	.....	.....	2,113,609
1862.	3,056,690	.....	.....	.....	.....	.....	.....	.....	.....	.....	3,056,690
1863.	2,611,309	.....	.....	.....	.....	.....	.....	.....	.....	.....	2,611,309
1864.	2,116,109	.....	.....	.....	.....	.....	.....	.....	.....	.....	2,116,109
1865,	1,585,200	912,500	.....	.....	.....	.....	.....	.....	.....	.....	2,497,700
1866,	2,502,700	1,095,000	.....	.....	.....	.....	.....	.....	.....	.....	3,597,700
1867,	2,393,300	954,000	.....	.....	.....	.....	.....	.....	.....	.....	3,347,300
1868.	3,072,617	547,500	26,000	.....	.....	.....	.....	.....	.....	.....	3,646,117
1869,	3,762,500	365,000	22,000	45,000	20,500	.....	.....	.....	.....	.....	4,215,000
1870,	3,039,528	173,585	813,150	918,644	315,838	.....	.....	.....	.....	.....	5,260,745
1871,	2,040,263	182,054	1,083,386	1,091,458	497,887	310,293	.....	.....	.....	.....	5,205,341
1872,	1,529,685	145,065	881,140	1,658,080	847,199	829,079	.....	.....	.....	.....	5,890,248
1873,	1,094,389	119,864	851,934	4,402,563	859,983	2,526,231	.....	.....	.....	.....	9,890,964
1874,	734,247	55,770	564,978	5,160,265	373,325	3,921,267	.....	.....	.....	.....	10,809,852
1875,	504,639	35,130	343,905	4,712,702	351,407	2,821,214	18,509	.....	.....	.....	8,787,506
1876,	611,884	37,450	333,640	4,755,623	354,284	2,377,700	382,768	64,220	51,337	.....	8,968,906
1877,	834,858	60,380	474,262	5,431,072	312,700	3,012,120	1,490,481	1,306,442	151,371	62,085	13,135,771
1878,	686,948	60,000	363,710	4,552,815	308,780	2,276,408	6,208,746	505,265	108,300	92,490	15,163,462
1879.	389,400	36,500	558,652	2,876,787	227,900	1,438,342	14,096,759	289,591	45,550	82,100	20,041,581
1880.	335,342	36,500	166,143	1,737,969	167,542	868,984	22,377,658	146,672	91,655	102,956	26,032,421

[TABLE N.]

PRODUCTION OF CRUDE PETROLEUM IN THE PENNSYLVANIA FIELDS, BY DISTRICTS, UP TO DECEMBER 31, 1882, AS CLASSIFIED BY THE SECOND GEOLOGICAL SURVEY.

(From Crew's *Practical Treaties on Petroleum.*)

YEAR	Oil Creek division.	Central Allegheny division.	Tidioute and Pagundus division	Beaver and Smith's Ferry division.	Pithole and Cashup division.	Butler and Armstrong division.	Clarion division.	Bradford division.	Warren and Forest division.	Bullion division.	Allegany County division, New York.	Total barrels of forty-two gallons
1859,	2,000	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	2.000
1860,	120,000	75.000	5.000	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	200.000
1861,	1.870,000	170,000	50.000	20,000	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	2.110.000
1862,	2,860,000	125.000	40,000	30.000	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	3.055,000
1863,	2,480,000	80.000	30.000	20.000	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	2.610.000
1864,	2.000.000	85.000	30,000	15,000	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	2,130.000
1865,	1.600,000	100.000	100.000	20,000	900.000	1,000	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	2.721,000
1866,	2,000,000	200.000	600.000	25,000	900.000	5,000	2,000	. . . . .	. . . . .	. . . . .	. . . . .	3,732,000
1867.	1.950,000	200.000	850.000	20.000	550.000	8,000	5,000	. . . . .	. . . . .	. . . . .	. . . . .	3,583.000
1868,	2,300,000	300.000	750,000	20,000	300,000	25.000	20,000	1.000	. . . . .	. . . . .	. . . . .	3.716.000
1869.	3.000.000	350,000	800,000	20,000	100,000	45,000	35,000	1.000	. . . . .	. . . . .	. . . . .	4.351,000
1870,	2,900,000	400.000	1,000,000	20.000	75,000	900.000	75,000	1.000	. . . . .	. . . . .	. . . . .	5.371,000
1871.	2,200,000	800.000	1,000,000	20,000	100.000	1.100.000	310,000	1.000	. . . . .	. . . . .	. . . . .	5,531.000
1872,	1,700,000	800.000	1,100.000	25.000	200,000	1,700,000	830,000	2,000	. . . . .	. . . . .	. . . . .	6,357 000
1873,	1,200.000	800.000	900,900	30.000	100,000	4.400.000	2,500.000	2,000	. . . . .	. . . . .	. . . . .	9,932,000
1874,	800.000	500,000	400,000	30.000	50.000	5.200.000	3,900.000	3,000	. . . . .	. . . . .	. . . . .	10.883.000
1875.	550.000	400,000	350,000	35,000	40.000	4,650.000	2.750.000	25.000	1.000	. . . . .	. . . . .	8.801.000
1876,	650.000	350.000	350,000	35.000	30.000	4,700.000	2.400,000	380.000	55.000	65.000	. . . . .	9,015.000
1877.	800,000	450.000	310,000	62.000	15.000	5.500.000	3,000,000	1,450,000	150.000	1,306.000	. . . . .	13,043.000
1878.	750.000	350,000	300.000	92.000	10,000	4.500,000	2.250.000	6.500,000	110.000	505.000	. . . . .	15.367,000
1879,	500.000	250.000	250,000	82,000	5.000	2.800.000	1.400.000	14.200.000	50,000	290.000	. . . . .	19.827 000
1880,	400,000	170.000	230,000	103.000	3,000	1.700.000	900.000	22,300,000	90,000	147.000	5.000	26 048 000
1881.	350,000	150,000	220.000	100.000	. . . . .	1.400,000	850,000	23.000.000	440,000	128.000	600,000	27.238,000
1882,	280.000	155.000	195.000	80,000	. . . . .	1,300,000	600.000	18,000,000	3,300.000	100,000	6.450.000	30,460.000
Total,	33,262,000	7,260,000	9,860.000	904.000	3,378,000	39,934.000	21,827.000	85,866,000	4,196,000	2.541,000	7,055.000	216,083,000

[TABLE O.]

SHIPMENTS OF CRUDE PETROLEUM FROM THE PENNSYLVANIA FIELDS, EACH MONTH, FROM JANUARY, 1871, TO DECEMBER, 1892.

(Barrels of 42 Gallons.)

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total
1871,	437,691	347,718	383,890	389,147	587,375	501,754	541,137	528,134	551,075	505,071	480,977	410,822	5,664,791
1872,	476,966	407,606	276,220	428,512	510,417	529,228	591,238	621,954	541,607	607,468	477,945	430,786	5,899,947
1873,	573,124	527,440	668,374	708,191	768,176	696,414	814,449	864,768	952,955	1,010,852	959,589	955,443	9,499,775
1874,	843,663	501,220	518,246	803,409	899,027	815,413	940,281	793,865	1,014,570	543,341	546,117	602,348	8,821,500
1875,	453,095	327,776	693,918	729,581	681,679	745,986	904,537	882,089	1,109,392	871,917	671,066	871,902	8,942,938
1876,	677,289	519,193	623,762	603,037	646,150	921,862	1,228,539	1,203,402	1,154,549	524,190	871,496	1,190,983	10,164,452
1877,	743,461	484,904	913,919	903,526	1,234,324	1,391,124	1,096,951	1,425,943	1,563,797	1,268,971	1,205,634	600,019	12,832,573
1878,	775,791	774,234	741,512	846,632	960,894	1,135,119	1,330,454	1,655,651	1,434,225	1,747,390	1,281,410	992,688	13,676,000
1879,	663,998	702,729	973,879	1,136,188	1,331,469	1,369,314	1,625,035	1,808,239	1,627,120	1,662,269	1,453,645	1,532,585	15,886,470
1880,	1,650,409	1,395,151	1,613,371	842,268	1,095,259	975,081	1,231,611	1,394,129	1,252,635	1,665,933	1,226,030	1,335,613	15,677,492
1881,	1,061,617	915,028	1,276,746	1,348,398	1,563,436	1,729,697	1,925,532	2,214,877	2,131,950	2,080,467	2,066,906	1,969,581	20,284,235
1882,	1,657,067	1,787,909	1,718,956	1,678,134	1,827,356	2,172,685	2,402,970	2,047,545	1,992,171	2,089,428	1,404,640	1,121,453	21,900,314
1883,	1,357,815	1,250,824	1,641,899	1,908,379	1,995,634	1,747,789	1,634,407	2,086,478	2,325,574	2,215,421	2,065,602	1,749,547	21,979,369
1884,	1,686,961	1,723,261	1,873,890	1,643,336	1,899,329	1,827,553	1,740,021	2,000,371	2,292,087	2,510,283	2,078,261	2,382,244	23,657,597
1885,	1,804,028	1,895,021	1,887,034	1,823,726	2,097,099	2,034,025	1,961,152	2,049,099	2,116,659	2,050,150	1,857,080	2,138,253	23,713,326
1886,	1,991,561	2,032,794	2,055,750	2,070,468	2,032,672	2,117,489	2,418,961	2,059,299	2,157,323	2,441,848	2,724,796	2,550,891	26,653,852
1887,	2,312,067	1,995,757	2,332,324	1,938,278	2,328,564	2,165,439	2,000,173	2,220,768	2,342,227	2,573,008	2,462,082	2,608,341	27,279,028
1888,	2,265,109	2,163,957	1,979,753	1,928,435	1,773,994	1,956,115	2,098,531	2,223,263	2,289,486	1,558,115	2,503,491	2,397,782	25,138,031
1889,	2,388,609	2,272,060	2,263,009	2,236,004	2,256,120	2,268,280	2,949,597	2,625,825	2,567,459	2,747,284	2,393,131	2,671,518	29,638,898
1890,	2,637,339	2,146,108	2,148,977	2,317,410	2,474,966	2,486,205	2,640,668	2,538,224	2,648,418	2,725,341	2,662,898	2,889,525	30,116,075
1891	2,569,993	2,268,168	2,531,832	2,248,530	2,151,710	2,259,540	2,309,531	2,579,076	2,829,480	2,900,732	2,685,570	2,859,778	30,193,940
1892,	2,498,650	2,397,479	2,779,528	2,205,693	2,338,230	2,138,399	2,262,402	2,696,880	2,828,717	2,892,191	2,978,984	3,031,791	31,048,944

[TABLE P.]

STOCKS OF CRUDE PETROLEUM IN THE PENNSYLVANIA FIELDS, AT THE END OF EACH MONTH, FROM JANUARY, 1871, TO DECEMBER, 1892.

(Barrels of 42 gallons.)

	January.	February	March.	April	May.	June.	July.	August.	September.	October.	November	December.	Averages.
1871	537.751	587.021	642.000	771,000	605,000	554.000	511.220	530.146	541.330	495.102	502.960	532,000	567,458
1872	532.971	579.793	662,497	877.832	950.803	1.010.302	990,229	997,166	951,410	914.423	886,909	1.084.423	869,897
1873	1,183,728	1.265.373	1,244,657	1.178.643	1.192,451	1.324.493	1.433.620	1,513,890	1.521.185	1.452.777	1,493.875	1.625.157	1,369,162
1874	1,948.919	2.283,032	2,648,210	2.623.534	2,594,286	2,701.625	2.279,479	2.932.444	2.758.504	3.134,902	3.449.845	3.705,639	2,755.035
1875	4.011,703	4.546,188	4.592,364	4,537.843	4.552,672	4,502.896	4,386,720	4.223.397	3.812.945	3.672.101	3.701.235	3.550,207	4,174.189
1876	3.585.143	3.734.835	3.829.250	3.900.703	3.989.904	3,791.642	3,326.726	3.304.405	2.930.456	3.040,108	2.955.092	2.551.199	3.411,622
1877	2.604.128	2.860.636	3.210.454	3.279,731	3,173,008	2,912.674	3,004.728	2.852.544	2.503,657	2.504,012	2.471,798	3.127.837	2,875.434
1878	3.555,342	3.875.964	4,342.832	4,692.090	4,996,058	5.078,189	5.031.600	4.717,877	4,599.362	4.221,769	4.289.309	4,615,299	4.501,308
1879	5,321,222	5.813.663	6.318,099	6.689,111	6.980.064	7.263,150	7,353,382	7,114.195	7,620,525	7,794.634	8.051,469	8.470,490	7,065,834
1880	8.724,194	9.004.062	9,606.683	10,780.153	11,916,577	13.099,934	14,116.753	15,063.651	16.157,316	16.877.019	18.025,409	18,928.430	13,525,015
1881	20,110.903	21,108.003	22.105.789	22,963,171	23.793,028	24,441,191	24.888.337	25.005,187	25,066,657	25,309,361	25,509,285	26.019,704	23.860.051
1882	26.716,188	27,059,611	27,822,825	28,547.481	29.206,697	29,859,952	30.715,144	31,772,094	32,400,303	32.608.533	33.728,555	34.596,612	30,419.500
1883	35,187,116	35.692.450	35,881.255	37.789,406	35.755,824	35.985.935	36.371.922	36.164,881	35.752,677	35,613.915	35.506,653	35.745,632	35.953.975
1884	35,884.509	36.041.898	36,220,270	36,642,794	38.631,203	38.665.838	38.985.767	39.084,561	38.740,734	38,192.317	37,925,756	37.366.126	37.698.481
1885	37.214,274	36,757.137	36.508.236	36.464.800	36.139.072	35.872.257	35,686,909	35,343,771	34.939.902	34.763,857	34,668.437	34,428,841	35.732,291
1886	34.186,238	34.082.775	33.954,493	33.823.385	33.969,486	34.187.377	34.428.490	34.800,397	35.061,614	35,027,877	34.525,871	34,156,605	34,350.384
1887	33,835,389	33.288.630	32.932.502	32.955.084	32,642.330	32.389.750	32,289.269	32,003.536	31.340.939	30.662.583	29.325.951	28,006.211	31.806.015
1888	26.927.634	26.084.574	25,404.276	24.893.223	24,653,043	24.219.496	23.586,951	22,825.298	21,876,681	20,722,024	19,734,132	18.995,814	23.326.929
1889	18.165.607	17.240,428	16,634,437	16.076.501	15,668.331	15.258.863	14.541.696	13,859.267	13,198.452	12.468.969	12.021,924	11.562.593	14.724,756
1890	11,060.220	10,990.417	11.170.997	11,178.990	11.062.100	10.866.587	10,663,497	10,526.613	10,346.878	10,263.258	10.080.538	9.993.600	10.682 807
1891	9,865,182	10,028,661	10.146.204	10,528.613	10,920.899	11,247,911	11,538,715	11,768.678	12.034.521	12,930.475	14.313.737	15.354.233	11.723 152
1892	15,902 468	16 451.731	16,735,298	17,249,534	17.681,830	18.276.895	18,694,562	18.816 683	18,844.937	18.080,523	17,730 444	17.395,389	17,655,024

[TABLE Q.]

NUMBER OF WELLS COMPLETED IN THE PENNSYLVANIA FIELDS, BY MONTHS AND DISTRICTS, DURING THE YEAR 1888.

(From data United States Geological Survey.)

MONTHS.	BRADFORD-ALLEGANY DISTRICT.			MIDDLE DISTRICT.			LOWER DISTRICT.			SOUTHWEST DISTRICT.			TOTALS.		
	Total number.	Productive.	Dry holes.	Total number.	Productive.	Dry holes.	Total number.	Productive.	Dry holes.	Total number.	Productive.	Dry holes.	Total number.	Productive.	Dry holes.
January	4	2	2	22	17	5	23	16	7	8	3	5	57	38	19
February	1	....	1	30	23	7	15	10	5	3	2	4	52	35	17
March	2	2	....	21	16	5	23	14	9	10	5	5	56	37	19
April	3	1	2	22	15	7	11	6	5	13	7	6	49	29	20
May	1	1	....	19	16	3	16	10	6	20	17	3	56	39	17
June	5	3	2	22	18	4	25	19	6	35	28	7	87	64	23
July	2	2	....	28	26	2	30	14	16	22	15	7	82	57	25
August	2	1	1	27	18	9	32	25	7	35	16	9	96	60	36
September	7	6	1	70	69	1	32	26	6	23	14	9	132	114	18
October	8	5	3	149	118	31	44	33	11	28	19	9	229	175	54
November	25	21	4	173	151	22	68	50	18	41	25	16	307	247	60
December	30	25	5	181	154	27	53	36	17	38	30	8	302	239	63
Total	90	69	21	764	641	123	372	259	113	279	181	98	1,505	1,134	371

[TABLE R.]

NUMBER OF WELLS COMPLETED IN THE PENNSYLVANIA FIELDS, BY MONTHS AND DISTRICTS, DURING THE YEAR 1889.

(From data United States Geological Survey.)

MONTHS	Bradford-Allegany.	Forest.	Warren.	Butler-Clarion-Venango.	Washington.	Allegheny.	Beaver.	Greene.	Total.
January,	39	4	32	180	16	7	.....	6	284
February,	34	1	16	207	10	14	.....	6	288
March,	52	2	38	196	49	8	.....	8	353
April,	59	1	52	224	51	6	3	5	401
May,	82	4	46	207	47	34	.....	11	431
June,	83	4	71	275	54	34	4	12	537
July,	107	9	62	228	60	69	.....	14	549
August,	104	7	65	233	71	23	.....	5	508
September,	97	2	70	222	50	5	26	6	478
October,	143	7	62	250	59	18	8	12	559
November,	121	9	72	252	56	5	15	10	540
December,	113	5	50	211	54	8	27	3	471
Total,	1,034	55	636	2,685	577	231	86	98	*5,435

* Including 36 wells drilled in Franklin district, data for which by months were not obtainable.

[TABLE S.]

NUMBER OF WELLS COMPLETED IN THE PENNSYLVANIA FIELDS, EACH MONTH, FROM JANUARY, 1872, TO DECEMBER, 1892.

YEARS.	January.	February	March.	April.	May.	June.	July.	August.	September.	October.	November.	December	Total.
1872	37	120	89	121	135	84	128	118	82	100	6	105	1,183
1873	93	94	100	105	102	130	114	120	106	101	100	98	1,263
1874	102	102	110	113	109	101	121	107	104	120	106	120	1,317
1875	190	187	195	186	172	190	200	210	201	220	217	230	2,398
1876	240	231	242	200	202	261	248	270	209	273	272	272	2,920
1877	281	241	291	269	320	303	317	255	322	467	391	382	3,939
1878	274	226	211	409	470	269	203	186	174	229	248	165	3,064
1879	136	132	238	270	402	330	327	283	210	232	227	261	3,048
1880	320	230	367	500	426	310	338	368	356	364	336	302	4,217
1881	222	220	271	316	406	374	336	332	312	322	363	406	3,880
1882	347	340	385	432	469	340	185	253	164	117	150	122	3,304
1883	125	126	142	209	231	228	261	309	321	321	302	272	2,847
1884	229	227	256	298	311	244	268	145	89	59	73	66	2,265
1885	64	62	82	116	213	242	217	283	356	397	384	345	2,761
1886	270	280	291	328	343	365	357	313	253	272	221	185	3,478
1887	158	162	138	160	148	162	159	142	134	100	101	96	1,660
1888	57	52	56	49	56	97	82	96	132	229	307	302	1,515
1889	284	288	353	401	431	537	549	508	478	559	540	471	*5,434
1890	553	482	522	556	534	571	589	624	571	567	520	348	6,435
1891	319	243	275	288	314	304	334	333	285	245	246	204	3,390
1892	183	180	149	168	183	161	179	142	146	157	165	141	1,954

* Including thirty-six wells drilled in Franklin district, data for which by months were not obtainable.

[TABLE T.]

NUMBER OF DRILLING WELLS IN THE PENNSYLVANIA FIELDS AT THE CLOSE OF EACH MONTH, FROM JANUARY, 1871, TO DECEMBER, 1892.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Averages.
1871.	140	173	240	279	356	303	329	330	439	486	477	394	329
1872.	363	369	313	302	386	391	359	392	301	311	354	318	347
1873.	361	349	227	177	228	395	340	267	197	163	137	60	242
1874.	37	55	99	213	225	210	180	128	107	82	57	54	121
1875.	40	40	45	64	127	162	118	96	132	170	179	168	112
1876.	142	151	236	267	307	340	353	374	511	565	618	493	363
1877.	457	463	395	448	512	395	365	417	535	573	565	426	463
1878.	334	326	379	409	376	266	188	185	240	282	297	218	292
1879.	265	323	406	468	460	384	329	258	270	313	372	440	357
1880.	540	535	577	580	460	440	452	515	491	469	475	408	495
1881.	383	420	437	446	470	408	379	352	388	445	475	468	423
1882.	422	438	408	405	381	226	240	194	177	184	154	138	281
1883.	126	151	205	199	216	228	262	315	314	341	301	263	243
1884.	270	273	260	284	244	123	123	91	79	100	86	78	168
1885.	97	109	139	190	228	209	242	308	382	355	359	277	241
1886.	320	337	356	318	358	403	349	290	322	272	285	238	321
1887.	201	177	155	155	157	142	135	137	107	104	114	88	139
1888.	64	72	65	59	82	106	124	106	166	187	327	273	136
1889.	341	350	453	487	574	612	598	598	600	698	659	610	548
1890.	597	615	645	603	585	617	690	691	632	644	542	445	609
1891.	407	410	401	387	380	407	420	406	406	390	351	287	388
1892.	265	270	251	231	234	254	203	242	234	245	229	238	241

[TABLE U.]

SUMMARY OF STATEMENTS MADE JANUARY 10, 1893, RELATING TO BUSINESS OF VARIOUS PIPE LINES FOR MONTH ENDING DECEMBER 31, 1892.

(In Barrels of 42 gallons each.)

	Total liabilities.	Gross stock.	Sediment and surplus.	Runs from wells.	Other receipts.	Regular deliveries.	Other deliveries.
National Transit Company,	11,908,341.60	13,462,723.19	1,554,381.59	784,215.37	682,789 18	562,303.45	1,027,632.45
Southwest Pennsylvania Pipe Lines,	1,755,863.57	1,942,544.20	186,680.63	575,725.60	50,602.68	1,231.60	593,326.08
The Eureka Pipe Line Company,	594,328 24	701,214.62	106,886.38	508,185.65	218,056.09	46,807.89	582,538.85
The Buckeye Pipe Line Company, Macksburg Oil,	422,141.62	438,648.84	16,507.22	196,851.67	2,139.68	6,442.51	204,715.75
Southern Pipe Line Company,	209,192.65	227,319.71	18,127.06	. . . . .	517,428.54	538,473.89	. . . . .
New York Transit Company,	584,782.77	758,505.62	173,722.85	. . . . .	955,118.40	1,187,425.85	. . . . .
	15,474,650.45	17,530,956.18	2,056,305.73	2,064,976.29	2,426,134.57	2,342,685.19	2,408,210.13

Total liabilities of the National Transit Company consisting of outstanding acceptances and other vouchers $6,376,262.39; Credit balances, $5,532,079.21.

[Table V.]

December, 1892. Statement of the Tide-Water Pipe Company, Limited, Made in Compliance with the Act of Assembly Approved May 22, 1878.

First. Quantity of crude petroleum which was in the actual and immediate custody of said company at the beginning of the month of December, 1892, barrels, 568,013.19

Quantity of crude petroleum which was in the actual and immediate custody of said company at the close of the month of December, 1892, showing where the same was located or held, describing in detail the location and designation of each tank or place of deposit, and the name of its owner, viz:

Designation of Tank.			Name of owner.	Location.	Barrels and 100ths of barrels of 42 gallons each.
Wood or iron.	Marked.	Numbered.			
Iron,	Tide-Water Pipe Company, Limited,	12	Tide-Water Pipe Company, Limited,	Otto township, McKean county, Pa.,	5,007.81
Do.	do.	25	do.	do.	6,000.98
Do.	do.	27	do.	do.	24,553.78
Do.	do.	37	do.	do.	35,273.56
Do.	do.	38	do.	do.	34,802.41
Do.	do.	39	do.	do.	4,315.29
Do.	do.	44	do.	do.	3,528.86
Do.	do.	46	do.	do.	35,354.70
Do.	do.	47	do.	do.	29,686.21
Do.	do.	105	do.	do.	18,437.25
Do.	do.	124	do.	do.	15,909.34
Do.	do.	138	do.	do.	3,404 06
Do.	do.	160	do.	do.	1,200.15
Do.	do.	161	do.	do.	829.74
Do.	Small tank or heater,		do.	do.	58.00
Wood,		334	do.	Lafayette township, McKean county, Pa.,	867.35
Do.		339	do.	do.	394.67
Do.		307	do.	Foster township, McKean county, Pa.,	261.15
Do.		335	do.	do.	69.00
Do.		336	do.	do.	825 89
Do.		337	do.	do.	1,065.18
Do.		338	do.	do.	1,234.76
Iron,	Tide-Water Pipe Company, Limited,	3	do.	do.	22,122 00
Do.	do.	4	do.	do.	13,693 52
Wood,		316	do.	Bradford township, McKean county, Pa.,	77.24
Do.		317	do.	do.	66 84
Wood,		310	do.	Keating township, McKean county, Pa.,	321 28
Do.		311	do.	do.	744 63
Do.		312	do.	do.	131.36
Iron,	Tide-Water Pipe Company, Limited,	21	do.	do.	5,826.60
Do.	do.	24	do.	do.	22,631.66
Wood,		308	do.	do.	145.09
Do.		309	do.	do.	455.86
Do.		329	do.	do.	591.06
Do		330	do.	do.	529.28

[TABLE V.] STATEMENT OF THE TIDE-WATER PIPE COMPANY, LIMITED—*Continued.*

DESIGNATION OF TANK.			Name of owner.	Location.	Barrels and 100ths of barrels of 42 gallons each.
Wood or iron.	Marked.	Numbered.			
Iron,	Tide-Water Pipe Company, Limited,	154	Tide-Water Pipe Company, Limited,	Eldred township, McKean county, Pa.	3,731.50
Wood.		318	do.	do.	271.30
Do.		319	do.	do.	1,057.00
Do.		320	do.	do.	816.54
Do		340	do.	Sargent township, McKean county, Pa.	146.73
Do.		341	do.	do.	320.33
Do.		342	do.	do.	1,006.02
Do.		343	do.	do.	72.84
Iron.	Tide-Water Pipe Company, Limited,	51	do.	Eulalia township, Potter county, Pa.	825.92
Do.	do.	131	do.	do.	24,042.26
Do.	do.	133	do.	Brown township, Lycoming county, Pa	32,321.27
Do.	do.	135	do.	Beaver township, Columbia county, Pa.,	32,284.08
Do.	do.	156	do.	Muncy Creek township, Lycoming county, Pa.	11,263.62
Do.		321	do.	Bolivar township, Allegany county, N. Y.	202.61
Wood.		322	do.	do.	295.43
Do.		323	do.	do.	250.77
Do.		324	do.	do.	121.87
Do.		325	do.	do.	409.81
Do.		326	do.	Alma township, Allegany county, N. Y.	614.14
Do.		327	do.	do.	418.93
Iron,	Tide-Water Pipe Company, Limited,	155	do.	Hudsondale, Carbon county Pa.	13,808.76
Do.	do.	59	do.	Bayonne, Hudson county, N. J.	34,697.47
Do.	do.	62	do.	do.	35,039.95
Do.	do.	64	do.	do.	34,117.59
Do.	do.	71	do.	do.	34,486.78
Do.	do.	72	do.	do.	34,754.82
Do.	do.	73	do.	do.	34,046.26
Do.	do.	158	do.	Changewater, Hunterdon county, N. J.	10,601.28
Do.	do.	159	do.	do.	13,072.58
	Total fluid in tanks.				645,479.02

MILES OF PIPE.	Inside diameter.	Capacity per mile.	Total capacity.	Estimated contents.
226.43	2.067 inches.	21,914 barrels.	4,961.98	2,480.99
72.50	3.067 inches.	48,247 barrels.	3,497.90	1,748.95
42.48	4.026 inches.	83,137 barrels.	3,531.65	3,531.65

292.96	6.065 inches.	188.672 barrels.	55,103.54	49,593.18	
1.40	7.982 inches.	326.790 barrels.	457.50	457.50	
.59	12.025 inches.	741.677 barrels.	437.59	437.59	
Total,					58,249.86
Total barrels,					703,728.88
Less sediment and surplus,					157,403.73
Net quantity of oil,					546,325.15

7–10 B.–92.

SECOND. { Quantity of crude petroleum which was received by said company during the month of December, 1892. . . . barrels, 139,020.22
Quantity of crude petroleum which was received from other lines during the month of December, 1892, . . . barrels, 59,513.80

THIRD. Quantity of crude petroleum which was delivered to refiners during the month of December, 1892. . . . barrels, 218,975.19

FOURTH. Quantity of crude petroleum for the delivery or custody of which said company was liable to other corporations, companies, associations, or persons, at the close of the month of December, 1892, . . . barrels, 546,325.15

FIFTH. Amount of such liability which was represented by outstanding certificates, accepted orders or other vouchers. . . . barrels. 18,000.00
Amount of such liability which was represented by credit balances, . . . barrels, 528,325.15

SIXTH. All the provisions of the act above referred to have been faithfully observed and obeyed during the said month of December, 1892.

No refined petroleum was in the custody of said company during the month of December, 1892, nor was said company liable during the month for the delivery of any refined petroleum.

W. S. BATCHELDER.
J. W. STAFFORD.

COMMONWEALTH OF PENNSYLVANIA, }
COUNTY OF CRAWFORD: }

Before me, a notary public, within and for said county, duly authorized by law to administer oaths, came personally W. S. Batchelder, having charge of the books and accounts of the Tide-Water Pipe Company, Limited, and J. W. Stafford, having charge of the pipes and tanks of said company, who being each duly sworn depose and say that they are familiar and acquainted with the business and condition of said company and with the facts set forth in the above report, and that the statements made therein are true to the best of their knowledge, information and belief.

Subscribed and sworn to before me this 5th day of January, 1893.

[SEAL.]

F. W. PERKINS,
Notary Public.

[TABLE W.]

QUANTITY AND VALUE OF CRUDE PETROLEUM EXPORTED FROM THE UNITED STATES, EACH YEAR, FROM JULY 1, 1863, TO JUNE 30, 1892.

YEAR ENDING JUNE 30.	GALLONS	DOLLARS.	YEAR ENDING JUNE 30.	GALLONS.	DOLLARS
1864.	11,125,433	4,540,631	1879.	25,874,488	2,180 413
1865.	13,330,328	7,703,969	1880.	28,297,997	1,927 207
1866.	16,803,987	6,472,876	1881.	39,984,844	3,065,464
1867.	7,905,344	2,106,284	1882.	41,304,997	3,129,511
1868.	10,717,233	1,790,660	1883.	52,712,306	3,914,941
1869.	13,425,566	2,994,404	1884.	67,186,329	5,302,974
1870.	10,403,314	2,237,292	1885.	81,037,992	5,903,833
1871.	9,859,038	1,971,847	1886.	80,246,763	5,859,577
1872.	13,559,768	2,307,111	1887.	76,062,878	4,860,382
1873.	18,439,407	3,010,050	1888.	85,538,725	5,782,008
1874.	17,776,419	2,099,696	1889.	72,987,383	5,083,132
1875.	14,718,114	1,406,018	1890.	95,450,653	6,744,235
1876.	20,520,397	2,220,268	1891.	91,415,095	5,876,452
1877.	26,819,202	3,756,729	1892.	103,532,767	5,101,840
1878.	26,936,727	2,694,018			

[TABLE X.]

QUANTITY AND VALUE OF CRUDE PETROLEUM EXPORTED FROM PHILADELPHIA, EACH YEAR, FROM JULY 1, 1863, TO JUNE 30, 1892.

YEAR ENDING JUNE 30.	GALLONS.	DOLLARS.	YEAR ENDING JUNE 30.	GALLONS.	DOLLARS.
1864.	2,087,114	670,774	1879.	4,687,786	377,197
1865.	1,110,907	488,751	1880.	2,730,147	160,549
1866.	5,096,037	1,639,991	1881.	5,326,528	351,736
1867.	3,047,117	655,575	1882.	4,454,946	288,581
1868.	3,778,871	622,677	1883.	6,959,240	460,857
1869.	1,409,603	289,202	1884.	5,557,310	400,833
1870.	3,005,916	608,415	1885.	29,542,316	2,082,561
1871.	2,588,007	442,944	1886.	33,452,742	2,327,344
1872.	5,951,795	999,064	1887.	35,892,185	2,204,847
1873.	4,981,872	821,449	1888.	39,908,874	2,530,308
1874.	4,395,953	473,020	1889.	30,440,884	1,974,204
1875.	3,662,247	324,116	1890.	45,039,903	2,803,070
1876.	8,663,564	873,592	1891.	45,307,725	2,522,317
1877.	4,262,093	558,101	1892.	65,898,042	2,908,987
1878.	4,809,278	471,871			

[TABLE Y.]

QUANTITY AND VALUE OF CRUDE PETROLEUM EXPORTED FROM EACH OF THE SHIPPING PORTS, EACH YEAR, FROM JULY 1, 1863, TO JUNE 30, 1892.

YEAR ENDING JUNE 30.	PHILADELPHIA.		NEW YORK.		BALTIMORE.		BOSTON.		ALL OTHER PORTS.		TOTAL. ALL PORTS.	
	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.
1864,	2,087,114	670,774	8,443,631	3,605,780	338,324	140,032	. . . . .	. . . . .	256,364	124,045	11,125,433	4,540,631
1865,	1,110,907	448,751	11,872,595	6,994,009	72,996	60,721	7,700	8,551	266,130	151,937	13,330,328	7,703,969
1866,	5,096,037	1,639,991	11,290,623	4,616,171	170,442	82,583	5,602	1,801	241,283	132,330	16,803,987	6,472,876
1867,	3,047,117	658,875	4,463,004	1,299,311	157,264	64,499	26,152	11,701	211,807	71,898	7,905,344	2,106,284
1868,	3,778,871	622,677	5,910,462	811,374	764,121	255,702	30,939	5,725	232,840	95,182	10,717,233	1,790,660
1869,	1,409,603	289,202	10,986,193	2,338,777	1,010,661	360,792	7,069	969	12,019	4,664	13,425,566	2,994,404
1870,	3,005,916	608,415	6,573,688	1,364,062	656,726	191,146	1,000	500	165,984	73,169	10,403,314	2,237,292
1871,	2,588,007	442,944	6,291,139	1,143,522	754,365	287,732	. . . . .	. . . . .	225,527	97,849	9,859,038	1,971,847
1872,	5,951,795	999,064	7,403,322	1,270,145	197,339	35,568	1,700	488	5,612	1,846	13,559,768	2,307,111
1873,	4,981,872	821,449	13,418,695	2,173,588	. . . . .	. . . . .	. . . . .	. . . . .	38,840	15,013	18,439,407	3,010,050
1874,	4,395,953	473,020	13,367,003	1,624,697	. . . . .	. . . . .	. . . . .	. . . . .	13,463	1,979	17,776,419	2,099,696
1875,	3,662,247	324,116	11,055,615	1,081,814	. . . . .	. . . . .	. . . . .	. . . . .	252	88	14,718,114	1,406,018
1876,	8,663,564	873,592	10,675,183	1,218,916	1,178,080	127,353	. . . . .	. . . . .	3,570	407	20,520,397	2,220,268
1877,	4,262,093	558,101	21,127,100	2,988,996	1,111,617	171,200	. . . . .	. . . . .	318,392	38,432	26,819,202	3,756,729
1878,	4,809,278	471,871	19,347,620	1,911,694	1,803,138	176,816	. . . . .	. . . . .	976,691	133,637	26,936,727	2,694,018
1879,	4,687,786	377,197	17,716,883	1,517,701	1,166,825	98,292	. . . . .	. . . . .	2,302,994	187,223	25,874,488	2,180,413
1880,	2,730,147	160,549	24,034,260	1,652,200	. . . . .	. . . . .	500	65	1,533,090	114,393	28,297,997	1,927,207
1881,	5,326,528	351,736	34,032,428	2,661,708	. . . . .	. . . . .	7,156	687	618,732	51,333	39,984,844	3,065,464
1882,	4,454,946	288,581	36,326,586	2,802,955	. . . . .	. . . . .	. . . . .	. . . . .	523,465	39,975	41,304,997	3,129,511
1883,	6,959,240	460,857	45,470,118	3,433,182	. . . . .	. . . . .	. . . . .	. . . . .	282,948	20,902	52,712,306	3,914,941
1884,	5,557,310	400,833	61,622,893	4,901,448	. . . . .	. . . . .	. . . . .	. . . . .	6,126	693	67,186,329	5,302,974
1885,	29,542,316	2,082,561	51,494,832	3,821,162	. . . . .	. . . . .	. . . . .	. . . . .	844	110	81,037,992	5,903,833
1886,	33,452,742	2,327,844	46,545,119	3,513,491	25,995	1,626	10,000	830	212,907	16,286	80,246,763	5,859,577
1887,	35,892,185	2,204,847	40,162,009	2,654,894	5,075	250	. . . . .	. . . . .	3,609	391	76,062,878	4,860,382
1888,	39,908,874	2,530,308	45,517,847	3,238,053	. . . . .	. . . . .	. . . . .	. . . . .	112,004	13,647	85,538,725	5,782,008
1889,	30,440,884	1,974,204	42,089,455	3,070,941	. . . . .	. . . . .	. . . . .	. . . . .	457,044	37,987	72,987,383	5,083,132
1890,	45,039,903	2,803,070	48,962,415	3,816,964	. . . . .	. . . . .	. . . . .	. . . . .	1,448,335	124,201	95,450,653	6,744,235
1891,	45,307,725	2,522,317	44,597,938	3,224,736	. . . . .	. . . . .	. . . . .	. . . . .	1,509,432	129,399	91,415,095	5,876,452
1892,	65,898,042	2,908,987	35,380,720	2,074,140	. . . . .	. . . . .	. . . . .	. . . . .	2,314,005	118,713	103,592,767	5,101,840

[TABLE Z.]

CAPITAL INVESTED IN THE PRODUCTION OF CRUDE PETROLEUM, VALUE OF MATERIALS USED IN PUMPING, CARING FOR AND OPERATING WELLS, AND AVERAGE CAPITAL PER WELL IN EACH OF THE DISTRICTS IN THE PENNSYLVANIA FIELDS IN 1889.

(Compiled from data Eleventh United States Census.)

DISTRICTS.	Total capital.	Total value of property, except land.	Total value of land.	Total acreage.	Value material operating wells.	Average capital per well.
Bradford-Allegany,	$32,288,195	$23,725,368	$8,562,827	182,861	$2,663,248	$1,982
Forest,	1,162,174	513,836	648,338	30,895	29,900	3,887
Warren,	10,680,618	6,709,094	3,971,524	88,486	1,022,966	2,558
Butler-Clarion-Venango-Armstrong, etc.,	26,020,574	17,698,370	8,322,204	351,278	1,787,296	3,121
Allegheny,	2,070,926	1,331,050	739,876	31,971	215,096	6,949
Beaver and Smith's Ferry,	2,203,219	1,205,164	998,055	28,812	214,026	8,160
Washington,	12,238,107	9,534,291	2,703,816	112,137	2,454,446	9,933
Greene,	2,171,763	1,193,336	978,427	42,083	274,460	9,401
Franklin,	726,432	466,642	259,790	4,876	31,953	1,151
Total,	$89,562,008	$62,377,151	$27,184,857	873,399	$8,633,391	$2,504

[TABLE AA.]

TOTAL CAPITAL INVESTED IN THE PRODUCTION OF CRUDE PETROLEUM IN THE PENNSYLVANIA FIELDS IN 1889, OTHER THAN THAT INVESTED IN LAND, COVERED BY TABLE Z.

(Compiled from data Eleventh United States Census.)

DISTRICTS.	Rigs, well engines, etc.	Tanks.	Tank cars.	Pipe lines.	Oil in stock December 31, 1889.	Other property.	Total.
Bradford-Allegany,	$20,149,046	$534,594	$510	$681,549	$181,376	$2,178,293	$23,725,368
Forest,	406,559	15,911	495	42,755	7,668	40,448	513,836
Warren,	5,575,578	160,376	.....	215,212	60,820	697,108	6,709,094
Butler-Clarion-Venango Armstrong, etc.,	16,654,912	421,192	5,250	233,300	70,676	313,040	17,698,370
Allegheny,	1,280,455	10,900	.....	4,771	6,857	28,067	1,331,050
Beaver and Smith's Ferry,	1,134,572	21,046	.....	2,632	18,904	28,010	1,205,164
Washington,	9,151,407	139,590	.....	81,819	99,054	62,421	9,534,291
Greene,	1,148,225	13,750	.....	2,762	950	27,650	1,193,336
Franklin,	435,441	10,255	1,000	4,128	.....	15,818	466,642
Total,	$55,936,194	$1,327,614	$7,255	$1,268,928	$446,305	$3,390,855	$62,377,151

[Table BB.]

Classes of Labor and Wages Paid in Pennsylvania Oil Fields in 1889, by Districts.

(Compiled from data Eleventh United States Census.)

Districts.	Foremen or overseers.		Mechanics.		Laborers.	
	Number.	Wages.	Number.	Wages.	Number.	Wages.
Bradford-Allegany,	432	$244,392	3,037	$913,488	2,709	$873,036
Forest,	13	9,039	77	33,785	99	42,850
Warren,	120	67,276	1,256	519,476	866	260,360
Butler-Clarion-Venango-Armstrong, etc.,	492	298,692	4,164	1,214,336	3,636	1,099,566
Allegheny,	17	12,613	155	134,386	142	61,131
Beaver and Smith's Ferry,	11	7,550	196	175,076	147	58,368
Washington,	117	85,356	894	611,697	477	254,671
Greene,	21	15,071	177	127,335	92	55,732
Franklin,	7	4,685	93	12,837	88	42,739
Total,	1,230	$744,674	10,049	$3,742,416	8,256	$2,748,453

[Table BB.]

Classes of Labor and Wages Paid in Pennsylvania Oil Fields in 1889, by Districts—*Concluded.*

Districts.	Boys under sixteen years.		Office.				Total number of employes.	Total wages paid.
			Males.		Females.			
	Number.	Wages.	Number.	Wages.	Number.	Wages.		
Bradford-Allegany,	31	$6,587	45	$56,479	1	$360	6,255	$2,094,342
Forest,	....	.....	2	1,125	...	.....	191	86,799
Warren,	20	6,600	24	11,032	...	.....	2,286	864,744
Butler-Clarion-Venango-Armstrong, etc.,	66	16,316	22	9,552	6	944	8,386	2,639,406
Allegheny,	....	.....	4	2,125	...	.....	318	210,255
Beaver and Smith's Ferry,	....	.....	...	.....	...	.....	354	240,994
Washington,	39	23,690	30	44,004	...	.....	1,557	1,019,418
Greene,	....	.....	6	8,800	...	.....	296	206,938
Franklin,	....	.....	1	624	...	.....	189	60,885
Total,	156	$53,193	134	$133,741	7	$1,304	19,832	$7,423,781

[TABLE CC.]

EMPLOYMENT OF LABOR IN PENNSYLVANIA OIL FIELDS IN 1889, BY DISTRICTS.

(Compiled from data Eleventh United States Census.)

DISTRICTS.	Building rigs.	Drilling wells.	Operating and caring for wells.	Torpedoing or cleaning wells.	Building or repairing tanks.	Building or repairing pipe lines.	Office.	Total wages paid.
Bradford-Allegany,	$120,868	$548,558	$1,296,607	$44,153	$9,286	$18,031	$56,839	$2,094,342
Forest, ...	5,015	31,849	45,547	110	1,562	1,591	1,125	86,799
Warren, ...	81,048	393,668	333,848	23,248	11,830	10,070	11,032	864,744
Butler-Clarion-Venango-Armstrong,	161,908	1,097,416	1,326,976	21,230	18,406	2,974	10,496	2,639,406
Allegheny, ...	8,919	117,977	79,565	. . . . .	1,669	. . . . .	2,125	210,255
Beaver and Smith's Ferry, ...	27,696	126,409	82,989	. . . .	3,900	. . . . .	. . . . .	240,594
Washington, ...	66,780	373,689	464,846	12,882	52,950	4,267	44,004	1,019,418
Greene, ...	3,277	75,747	101,191	3,572	10,590	3,761	8,800	206,938
Franklin, ...	2,703	15,482	41,570	431	75	. . . . .	624	60,885
Total, ...	$478,214	$2,780,795	$3,773,139	$105,626	$110,268	$40,694	$135,045	$7,423,781

[TABLE DD.]

STATISTICS OF LABOR EMPLOYED IN THE PRODUCTION OF CRUDE PETROLEUM, DURING THE YEAR ENDING MAY 31, 1880.

(From data Tenth United States Census.)

NAME OF DISTRICT.	Number of wells drilled.	Estimated number of men employed in drilling wells.	Estimated number of men employed in caring for wells.	Estimated number of skilled workmen.	Average rate of wages.	Estimated number of ordinary laborers.	Average rate of wages.	Total number of men employed.	Total amount of wages paid.
Bradford, ...	3,080	3,000	2,000	1,851	$2 50-4 00	4,717	$1 50-2 00	5,968	$3,828,600
Lower country, .	335	350	4,500	208	2 50-4 00	4,736	1 50-2 00	4,944	3,012,300
Franklin, ...	120	50	120	15	2 50-4 00	155	1 50-2 00	170	102,000
Beaver county, .	15	10	60	12	2 50-4 00	63	1 50-2 00	75	45,000
Total, . . .	3,550	3,410	6,780	2,086	. . . . .	9,671	. . . . .	11,157	$6,987,900

[Table EE.]

Classification of Labor Employed in the Production of Crude Petroleum, by Districts, During the Year Ending December 31, 1889.

(From data Eleventh United States Census.)

Class of Labor.	Bradford—Allegany District.		Forest County District.		Warren County District.		Butler — Clarion — Venango District.		Allegheny County District.	
	Number of Each Class.	Range of wages.	Number of each class.	Range of wages.	Number of each class.	Range of wages.	Number of each class.	Range of wages.	Number of each class.	Range of wages
Foremen.	207	$100 to $133 per month.	9	$50 to $100 per month.	62	$40 to $100 per month.	134	$20 to $100 per month.	17	$45 to $100 per month.
Pumpers or engineers	2,209	$5 to $85 per month.	57	$20 to $60 per month.	442	$10 to $75 per month	2,538	$30 to $85 per month.	144	$20 to $65 per month.
Carpenters, ...	687	$2 to $3.50 per day.	10	$2 to $3.50 per day.	204	$2.50 to $3.25 per day.	286	$1.25 to $3 per day.	10	$2.50 per day.
Rig builders.	601	$50 to $190 per rig. / $2.50 to $3 per day.	25	$62.75 to $125 per rig.	302	$65 to $200 per rig.	1,234	$50 to $200 per rig.	46	$100 to $180 per rig.
Drillers, ...	1,061	40 cents to $1 per foot. / $3.50 to $4 per day.	50	40 to 60 cents per foot.	616	$40 to $90 per month.	2,474	35 cts to $1.00 per foot.	85	50 cts. to 1.15 per foot.
Tool dressers. . . .	22	$2.50 to $3 per day.	5	$3 to $3.50 per day,	34	$3 to $3.50 per day.	32	$2.50 to $3 per day.		
Laborers.	882	$1.25 to $2.50 per day.	22	$1.50 to $2.50 per day.	444	$1.50 to $2 per day.	818	$1 to $2.50 per day.	6	$50 to $60 per month.
Teamsters, ...	52	$50 to $125 per month.	7	$5 per day.	86	$1.50 to $5 per day.	110	$2.50 to $5 per day.		
Boys under 16 years, .	8	$1 to $1.50 per day.					18	$10 to $20 per month.		
Well cleaners. . . .	334	$4 to $6.25 per day.	2	$5 per day.	84	$5 per day.	274	$2.50 to $5 per day.	2	$2.50 to $3.50 per day.
Sundry mechanics, .	69	$50 per month. / $2.50 to $4 per day.	1	$60 per month.	20	$1.70 to $3 50 per day.	74	$1.25 to $4 per day.		
Totals, ...	6,132		188		2,294		7,992		310	

[TABLE EE.]

CLASSIFICATION OF LABOR EMPLOYED IN THE PRODUCTION OF CRUDE PETROLEUM, BY DISTRICTS, DURING THE YEAR ENDING DECEMBER 31, 1889—*Concluded.*

(From data Eleventh United States Census.)

CLASS OF LABOR.	BEAVER COUNTY DISTRICT.		WASHINGTON COUNTY DISTRICT.		GREENE COUNTY DISTRICT.		FRANKLIN DISTRICT.		Total number of laborers.
	Number of each class.	Range of wages.	Number of each class.	Range of wages.	Number of each class.	Range of wages.	Number of each class.	Range of wages.	
Foremen,	9	$50 to $150 per month.	90	$80 to $125 per month.	*21	No record.	5	$60 to $75 per month.	554
Pumpers or engineers,	81	$8.33⅓ to $70 per month.	610	$15 to $60 per month.	95	do.	69	$8 to $57.50 per month	6,245
Carpenters,	13	$2.50 per day.	30	$2.50 to $3 per day.	5	do.	15	$1.75 to $3 per day.	1,260
Rig builders,	42	$110 to $225.50 per rig.	198	$150 to $200 per rig.	5	do.	20	$35 to $80 per rig.	2,473
Drillers,	84	$70 to $90 per month.	588	$1 to $1.50 per foot.	65	do.	59	50 to 60 cents per foot.	5,082
Tool dressers,	...	...	6	$5 per day.	...	...	2	$2.50 per day.	101
Laborers,	35	$1.39 to $2 per day.	252	$1.25 to $2.50 per day.	92	do.	12	$1.50 to $2 per day.	2,563
Teamsters,	1	½ cent per gallon.	...	...	...	...	1	$1.50 per day	257
Boys under 16 years,	...	...	...	...	...	...	...	...	26
Well cleaners,	...	...	36	$2 to $5 per day.	5	do	...	...	737
Sundry mechanics	18	$61.39 per month.	21	$50 to $60 per month.	2	do.	1	$5.27 per day.	206
Totals,	283		1,831		290		184		19,504

* Estimated.

PART II.—PETROLEUM PRODUCTS.

EARLY METHODS OF MANUFACTURE.

Coal Oil.—"Cracking."—Humboldt Refinery.

Coal Oil.—In a few instances, petroleum has been obtained from the earth of color and odor so good that it could be burned for illuminating purposes in its natural state. Again, in a few instances, somewhat more numerous than those just mentioned, but still limited in number, oils have been found, heavy in gravity, and so free from both light ingredients and paraffine, that they are excellent lubricants in the condition in which they come from the ground. But these instances are so few that we can give it as a rule that all the uses to which petroleum is put require a manufactured article.

A study into the methods of manufacture soon shows the youth of the petroleum industry. In 1861, Gessner's *Coal, Petroleum, and Other Distillate Oils*, just published, was reviewed in the *American Journal of Science and Arts;* and, in the course of the article, the reviewer casually remarks: "It is quite possible that the future historian of the industrial arts may look back on the coal oil distillation as only an episode in the history of the development of the use of petroleum." This was written only thirty-two years ago, the manufacture of petroleum into products being then scarcely thought of. It was lack of oil rather than means or methods for refining it that stood in the way of its use. Drake sold his crude at 75 cents per gallon, and in 1862, Isaiah Warren, who was distilling West Virginia crude in three 15-barrel stills, feared that he might produce an over-supply and break the market, which then was one dollar per gallon.

Although the industry of petroleum manufacture is not more than thirty years old, the production of mineral oil, or, as a patent granted in 1694, puts it, "pitch, tar and oyle out of a kind of stone," dates back several centuries. This oil was made from peat or coal. The works of Messrs. Binney & Young, of Scotland, now historic because of the bitter law suits against manufacturers in this country for infringement, were erected to distill oil from bituminous or Boghead coal. This coal was imported into the United States, and a royalty of four cents per gallon (more than the total price of the manufactured article to-day), was for a time paid the Scotch inventors. But when it was found that our American coal, especially the Breckenridge, would serve that purpose quite as well, the payment of royalty was discontinued, and the suits referred

to commenced. The defeat of the Scotch claimants soon established a considerable industry in this country distilling different coals for illuminating oils.

As early as 1833, Prof. Silliman had distilled the natural petroleum, but only in an experimental way for the naphtha it contained, to be used for preserving purposes. In 1834, Samuel M. Kier, whose circular advertising his patent medicine, "American Oil," suggested to Bissell the drilling of artesian wells to find crude, started his works. A five-barrel still, furnished with oil from his father's salt wells, was sufficient to supply all demands. It is generally conceded, we believe, that this was the first refinery in America to distil the natural petroleum.

When Drake opened the way to an indefinite production of crude, there were many coal oil refineries in active operation ready to turn from the distillation of coal or shale to this cheaper and more tractable article. Two large refineries, one built on Newtown creek, almost at the site of the present Kings County Oil Works, on Long Island, by L. F. Cozzens, the West Point hotel proprietor, and the original Delmonico, and the other, the Empire Works in South Brooklyn, also on Long Island, had just begun a successful career. The projects represented by these works had to be abandoned when the existence of Pennsylvania crude became known, and the plants were sold at a great sacrifice and rearranged for the distillation of petroleum. It was in such stills as those at the works named, constructed originally for handling coal, that refined oil was first manufactured in commercial quantities. The stills were of twenty-five barrels capacity, made of cast iron, oval in shape, composed of three pieces bolted or riveted together. The parts were a cylindrical cast-iron body, a very heavy boiler-plate bottom, and a cast-iron dome-shaped top. This dome was provided with a manhole and a cast-iron gooseneck, to carry the vapors from the still over into the condenser pipe. These stills were set in thick brick-work, which extended up around their sides and over their tops, with flues so arranged that every part of the enclosed vessels was subjected to most intense heat. The cast-iron gooseneck was reduced from four feet in diameter at the still to eighteen inches at the worm, which was either a copper coil or straight cast-iron pipe of convenient lengths, immersed in a tank of water. The condenser worm was reduced from eighteen inches at the gooseneck to nine inches at the outlet. The aim in distilling was to empty the still as rapidly as possible. The quality of the products secured can be imagined; the charge being distilled to dryness, and the coke left in the still being often so hard that it had to be cut out with a chisel.

CRACKING.—The first great step forward in the art of refining was the result of an accident. Crude petroleum is made up of a great number of differently compounded hydrocarbons. The earlier methods of rapid running resulted in a simple fractional distillation, these compounds

being separated from one another as the degree of heat was increased and, beginning with the lightest, were vaporized and passed over as a vapor into the condenser coil to be there reduced to liquid form by being cooled. Such a distillation produced a series of products following one another in regular order from the lightest in gravity or density down to the heaviest, until the liquid in the still was all vaporized, and nothing was left but the dry or burnt oil on the sides and bottom. Cracking is the technical term for destructive distillation; whereby the compounds of which the crude is composed are separated not only from one another, but to a degree into their component parts, and new compounds are allowed to be formed. The result is that vapors are thrown over into the condenser worm, that liquefy into products of lighter gravity, in other words, of less density; while the heavy vapors, being condensed in the still before passing into the worm, fall back into the liquid in the still, to be again and again vaporized and decomposed.

It was by accident that it was discovered that the compound known as crude oil could, by destructive distillation, be converted into compounds of greater simplicity of construction, the lighter ones which are more valuable for the production of illuminating oils, being carried over into the condenser worm to be there liquefied, and the heavier ones left in the still to be further broken up, or reduced to liquid residuum in the still or a dry sediment or coke on its bottom.

Allen Norton Leet, in one of the articles he contributed to the *Oil, Paint and Drug Reporter*, a weekly journal published in New York, claims that the discovery was made at a little works in Newark, N. J., in the winter of 1861–62. The stillman went to his dinner one day when the still was about half empty, the distillate coming from it being 43° gravity, and everything indicating that the usual emptying of the still by the gradual production of heavier and heavier gravities would follow. He was unable to return to his work for several hours. When he did so the fire under the still was nearly out, but, to his surprise, there was running from the worm a stream of oil of light color and 48° gravity; and when, in alarm, he drew out what little fire remained under the still and allowed it to become even cooler, the gravity of the product of the worm ran up to 52°. The proprietor of the establishment then made some runs in a glass retort, and soon learned that after the great body of crude had been distilled and the lighter part driven off by heat, if the fire was reduced, the vapors were condensed in the still, only the lighter ones passing over into the worm. In those days the only product of any value was the illuminating oil, and an increase in yield of 10 per cent. or more meant a source of large revenue, even to a small works.

It was found that these lighter gravity oils from "cracking" were darker in color, making it apparent that the vapors must have been burned, a fair inference from the setting of the still surrounded by flues,

subjecting the part of the vessel above the line of liquid to almost as intense heat as the small part below it. The still was reset. Only one-third was now inclosed in brick, the upper third being covered with a thin coat of cement, and the lower third exposed to the fire. The flues that ran along the sides were fitted with dampers to cut off the heat, during the latter part of the run, from the upper portion of the still, which then acted as a condenser to drop the vapors back again into the oil below. This change increased the yield of burning oil fully 20 per cent. By means of retarding the distillation the same result in the way of destructive distillation was secured as would have been reached had the distillation taken place under pressure. The heavy vapors struck the upper part of the still, were condensed and dripped back into the oil below, which was at a higher temperature than the boiling point of the oil falling back. This produced decomposition in the oils by superheating the vapors. The discovery was soon known at all refineries, both at the seaboard and in the region, and methods of manufacture were revolutionized.

HUMBOLDT REFINERY.—On the opening up of the producing territory along Oil creek in 1860 numerous primitive small refineries appeared in an incredibly short time on the banks of that stream. This location was selected because of its proximity to the production of crude, and also because the creek served as a sewer to carry away the refuse from the works. The construction was of the rudest character, consisting of one or two cast-iron stills of a few barrels capacity, a copper worm, a tin or zinc-lined tank for treating the distillate, which was agitated by hand with a wooden paddle, and a tin-lined tank for settling the oil. Fires were frequent, often resulting in the total obliteration of the entire plant. The first two works in the state worthy of the name of refinery were the well-known Humboldt, at Plummer on Cherry run, a little stream entering into Oil creek half way between Titusville and Oil City, and Downer's works, at Corry, both built in 1862. At the former works an effort was, for the first time, made to erect a refinery that would, to some extent at least, be free from fires. At the latter a careful and, for those days, scientific study of the many problems belonging to the art of petroleum manufacture, some of which are still unsolved, was pursued. The Humboldt works were dependent for crude on the production of the neighboring territory. This became exhausted in 1866, and, as the nearest railroad source of supply was Titusville in one direction and Oil City in the other, the works were forced to stop and were soon dismantled. The Downer works could both receive their crude and ship their product by rail.

A brief discription of the Humboldt refinery will be of interest. We are indebted for it in the main to Mr. Leet, who was their refiner and chemist. Twenty horizontal stills of boiler iron, with sides three-eighths inch thick and bottoms one-half inch thick, served as the nucleus for the

works. The stills were built with domes on top from which a cast-iron gooseneck carried the vapors over into the condenser of straight pipes run the whole length of a water box 300 feet long. The mouth of the worm was thus carried far enough away from the stills to prevent the uncondensed vapors from being ignited by the still fires. The condensed vapors were received in small tanks from which the naphtha could be run into a storage tank and the distillate emptied into the distillate tanks. From these it was pumped through a four-inch pipe up to the treating house. This was a five-story building with an iron tank on each floor emptying each into the tank below. The one on the first floor was connected by pipe with another building 500 feet away containing iron settling pans. Bells and speaking tubes enabled the stillman watching the distillate at the end of the long condenser to give his orders to the fireman 300 feet away. The distillate for treating was pumped up to the top one in the series of tanks in the treating house, where sulphuric acid was applied to it and the mixture agitated by means of compressed air. The sludge secured was drawn off and the distillate dropped into the next lower tank for washing with water. The water was drawn off and the distillate dropped again into a lower tank for washing with soda. This was drawn off and the distillate again dropped into the lowest tank for final washing. After this it was run into the settling tank. After settling, the oil was put into barrels furnished from a barrel factory a thousand feet away. The crude was supplied from two large tanks on the hillside overlooking the works, running into the stills by force of gravity. The fuel used was the liquid refuse, the naphtha, heavy oil and residuum made at the works. It will be seen that in many points this refinery was almost as complete as some that to-day claim to be modern.

PRESENT METHODS OF MANUFACTURE.

Refined Oil.—Crude Oil Stills.—Condensers.—Distillation of Crude.—Steam Stills.—Treatment with Chemicals and Washing.—Naphtha and Naphtha Products.—Products from Residuum.—Paraffine Wax.—Reduced Lubricating Oils.

REFINED OIL.—It is no exaggeration to say that two hundred different products are now made from crude petroleum. The limits of such a report as this will not, of course, permit even mention of each further than to outline some general classification. The broadest that can be made is to divide the products into those that result from the distillation, and those that result from the reduction of the crude article. Every product, we think it safe to say, that has been obtained from crude oil, is secured by one or the other, or in some cases, by a combination of both of these processes. By distillation we mean the converting of the crude by heat into vapors and the condensation of those vapors back to a liquid, from which the manufactured article is produced. By reduction we mean the driving out of the crude by heat its lighter portions, leaving the remaining product behind still in liquid form. Products of both classes can be, and usually are, made by the same process; that is, while heat is converting one part of the crude oil into products by distillation, that is, turning them into vapor for condensation, it is at the same time converting the other part into a product of reduction by driving off the very vapors that make the distillate products. Again; both processes are often resorted to in successive stages of manufacture, to produce certain articles. A distillate product is afterwards reduced, and a reduced product is afterwards distilled; in some instances the processes being repeated several times before the finished goods are secured. This is particularly true of the lighter and the heavier parts resulting from the method of manufacture, aiming to convert the major part of the oil under manipulation into some desired product. These lighter and heavier parts are therefore known to petroleum manufacturers as by-products. As petroleum in its crude state is composed of an almost indefinite number of differently compounded hydrocarbons, that is, combinations of the chemist's elementary substances carbon and hydrogen, varying in volatility; and as the manufactured products are almost countless in number, it will be readily understood that the methods of manufacture must be many, complicated and delicate. In the early days of the industry, but one product was sought for, and today the staple article of manufacture is that same product secured, however, in many grades. We refer to refined oil. But the possibility of making other valuable products was soon apparent, and each year experience and study in the art has developed almost unlimited extension of the uses of petroleum.

ECLIPSE REFINERY, FRANKLIN.

The main product of petroleum, refined oil for illuminating purposes, is always the result of distillation. At many large works to-day the crude oil, which is the base of all petroleum products, is received into storage tanks of 30,000 to 35,000 barrels capacity direct from the main trunk pipe-lines already described. Formerly crude came to the works in barrels, from which it was emptied into troughs and flowed through a sieve, to catch solid impurities, into tanks. Some of the less important refineries do not have this direct connection with the pipe-lines, and crude is brought to them in tank cars. These have an outlet valve at the bottom to which hose is connected carrying the oil into a large pipe which conveys it to the tank from which the stills are filled. When the stills are ready to be charged, powerful pumps force the crude oil through large lines into them, as it is important that time should not be wasted in this preliminary work. A careful refiner makes sure that no water is pumped with the crude into his stills; for if it is, it must also be evaporated, as well as the oil.

The production of refined oil is the result of four distinct steps. (1.) Fractional distillation (that is, the vaporizing and condensing of the oil) in a still heated by fire. (2.) Fractional distillation in a still heated by steam. This is really a reducing process so far as the refined oil is concerned. (3.) Treating the distillates with chemicals and washing them with water. (4.) Settling to make the oil clear and bright for delivery.

Crude Oil Stills.—Many different sizes of stills have been tried, from the primative cast-iron ones of a few barrels capacity of the early days to the huge cheese-box vessels holding 3,000 and 3,500 barrels erected at several works, and many different varieties have been tested—upright cylinders, horizontal cylinders, cheeseboxes of various construction, not to mention the unsuccessful devices for effecting continuous distillation. Experience has narrowed the style of stills down to two, their competing merits being a source of much controversy among practical men. These are known as the cylinder and the cheesebox still. The former is a simple horizontal steel or wrought iron cylinder twelve and one-half feet or a little more in diameter and thirty feet or a little more in length. A cylinder of this size holds about 600 barrels of crude, and is the size generally found at the seaboard works. A circular dome about five feet in diameter and four or five feet high is set on the top of the still in the center, as an outlet for the rising vapors; a wrought-iron gooseneck fifteen inches in diameter, conducting them over to the condenser pipe, to be described later. The still rests on brick work which surrounds the lower half, the upper half being left exposed to facilitate the "cracking" or destructive distillation of the oil already explained. A double fire-box is built under the front quarter of the still, but, by having the flue for the exit of the gases of combustion in the rear, the heat is applied to the whole length of the bottom and well up on the sides of the cyl-

inder. Some of these stills have flues running along their sides, with dampers to cut off the heat at certain stages of the run. The advocates of this style of still claim for it cheapness of construction, because of its simplicity, economy in repairs, and the largest amount of work accomplished with a given quantity of fuel.

Cheesebox stills are somewhat more complicated in construction. They consist of a vertical cylinder ten feet or a little more in height and thirty feet or a little more in diameter, of five-sixteenth inch wrought-iron, with a dome-shaped top of the same material, and a five-sixteenth inch steel bottom made in a double curve to provide for expansion. The center is supported on a circular pier of brickwork, which serves also for an exit for the gases of combustion through an underground flue to the chimney. From the central pier a number of brick arches are sprung to the circumference. These arches support the still and form the sides for fireboxes, of which there are varying numbers according to the design of the builder. These fireboxes are placed at equal distances from each other on the circumference of the still. A still of the size mentioned above holds about 1,200 barrels of crude. The vapors from the distilled oil pass through three pipes into a vapor chest above the top of the still, from which they are conveyed through a large number of three-inch pipes over into the condenser. The advocates of this style of construction claim for it the production of a larger yield of refined oil distillate, of lighter gravity and superior color.

Both the cylinder and the cheesebox stills are provided with manholes, covered when the still is charged by circular plates held in place by screws and bolts. One manhole is on the top of the still and one near the bottom, on the end in the case of cylinder and side in the case of cheesebox stills. These are opened to cool the still after it has been run off, the upper one admitting men to clean and inspect it, the lower one being convenient for the men to throw out the coke or dirty sediment that has dried on the bottom and sides during the run. The stills are also provided with steam pipes of various plans, charging and draw-off pipes, gauges, vacuum and pressure valves, and many other devices that we have not space to describe.

CONDENSERS.—Originally these were copper coils, which were soon supplanted by coils of iron pipe in a tank of water. Coils of pipe are still sometimes used, but the general plan for condensers is to have straight pipe of convenient lengths laid one above another, and connected together by return bends or manifolds in a rectangular box of iron or wood. Sometimes the distillate is carried through the condenser by a number of separate pipes. In other cases all the vapor passes through one continuous pipe. The aim of the different designs is to secure the most perfect condensation of the oil vapors. Any vapor reaching the end of the condenser pipe in the form of gas is taken away to be burned for fuel. The condensed vapor is received at what is known

IMPERIAL REFINERY, OIL CITY.

as the running room, where it is watched and tested by the refiner and turned into such one of the several tanks set apart for the different products as, from time to time during the progress of the run, seems best.

Distillation of Crude.—As soon as the stills are filled a gentle fire is started under them, and the more volatile constituents of the crude are driven off into the condensers where they are cooled sufficiently to be liquefied, flowing as a fluid from the end of the worm. Some of the very lightest of the naphtha distillate can be condensed only at low temperatures, and then held in liquid form only under pressure. Usually this is not attempted, but the vapor is allowed to escape in gaseous form to be burned for fuel either under the stills or boilers. It is not possible to describe the distillation or "run" in other than very general details, the points of separation of products varying with different grades of crude, with the proportion of the different products desired by manufacturers at different times using the same crude, and in accordance with the ideas of the most economical method for securing the best results held by different refiners. As the fire under the still is increased in intensity the condensed vapors that appear at the mouth of the worm in what is known as the "running room" grow heavier as the run progresses, and separations or "cuts" are made by the refiner turning the stream into this or that receiving tank as his judgment directs. The points of demarkation between what is known as naphtha and as oil distillate or distillate and residuum are, as can be readily understood, purely arbitrary ones. In fact, even after the most careful separation, it is found that the heavy naphtha contains considerable of the oil distillate, and the oil distillate quite a quantity of the heavy naphtha product. Generally the distillation is fractionated into four parts—a light and a heavy naphtha and two separations in the oil distillate, leaving a residuum or tar in the still. In the running of these products the gravity or density of the condensed distillates continue to grow heavier until a point is reached where, in the judgment of the refiner, the color has become so dark that the distillate cannot be treated up to a satisfactory shade in the finished oil. Then the fires are slackened in order to allow the "cracking," already described, to occur. By this the vapors are decomposed or split up into heavier and lighter ones, the former dropping back into the boiling oil, the latter passing over into the condenser pipe to be reduced to liquid form. During this process of "cracking" considerable quantities of uncondensable or permanent gas are produced and utilized for fuel.

From the different Pennsylvania crudes the range of products is somewhat as follows:

Naphtha, . . .	from	8 to 20	per cent.
Refined oils, .	from	78 to 70	per cent.
Residuum, . .	from	9 to 5	per cent.
Loss, about . .		5	per cent.

The gravities of naphtha range form 90° to 62°, the gravities of refined oil distillate from 50° to 44°, the gravities of residuum from 25° to 16°.

The yields and gravities vary according to the crude run and the products to be secured. There is left on the bottom and sides of the still, after drawing out the liquid residuum, from one to one and a half per cent. of the original charge, in the form of a coke or solid deposit. This is thrown out and used as fuel. The time required to run off a still of the sizes we have described is from three to four days.

STEAM STILLS.—The naphtha and oil distillates that have come from the crude stills are next put into a still worked entirely by steam. These stills are either horizontal cylinders or upright cheeseboxes holding about 1,000 barrels each. The distillation in them is effected by means of steam coils run along their bottom and top. Of the refining of crude naphtha in these stills we will speak more specifically later. Distillates for illuminating oils are subjected to a reducing, not a distilling process at this stage of manufacture. The aim is simply to drive off the inflammable gases carried over with the heavier product in fractionating the crude, in order that the distillate may be rendered safer for consumption in lamps. The heat of the steam vaporizes the more volatile gases and carries them into a condenser to be liquefied the same as distillate from a crude still. This elimination of the lighter parts from the distillate is continued until the body of the distillate in the still will stand the fire test required. By fire test is meant the temperature at which the oil will give off sufficient gas to ignite and burn.

TREATMENT WITH CHEMICALS AND WASHING.—The refined oil distillate as it comes from the crude stills is impregnated with tarry matter and inflammable gases, imparting a greenish color and an offensive odor. The gases are driven off in the steam still just described. The color and odor of the distillate after it has been steam-stilled are improved by the purifying action of chemicals and a thorough washing with water. The outline given of the method of treatment employed in early times at the Humboldt refinery, in our section describing those works, would serve almost as well for a description of the process employed to-day; except that then the distillate was moved from one tank to another for the several stages of the work, while it now remains in the same vessel throughout the treatment. This is called an agitator—a large vertical cylinder holding from one to two thousand barrels, generally lined with lead. It is built with a conical bottom to facilitate the removal of the objectionable impurities and water, as the treatment progresses. The agitator having been filled with distillate, sulphuric acid is mixed with it, and the distillate and acid are thoroughly agitated by means of an air blast introduced at the base of the conical bottom. When the air blast is shut off, the acid, completely charged with the resinous matter which it has picked up in its contact with the distillate, gradually sinks by its gravity to the bottom, from which it is readily drawn off as sludge without dis-

PHILADELPHIA REFINERY.

turbing the purified distillate above. The distillate is then treated in the same way with soda or some other alkali, to neutralize any trace of acid that may be left in it. The soda is drawn off in the same way as the acid. After these agitations, the distillate is thoroughly washed with water sprayed on its top and allowed to percolate through to the bottom; the number of washings and the manner of applying the water differing somewhat at different works; this remark is true also of the manner of applying the acid and alkali. The sludge is turned over to acid-restoring factories or to fertilizer works; the former producing fresh acid, and the latter making ammoniated phosphates from it. The treated distillate is now allowed to run down, or is pumped away, into broad shallow tanks called settling pans where it is allowed to stand for any water or other impurities that may still remain in it to slowly settle out, a steam coil at some works being used to furnish the necessary heat in cold weather to raise the temperature to the proper point to facilitate this separation. The oil is now bright, clear and clean, ready for delivery.

Naphtha and Naphtha Products.—We cannot help but recognize that the number and variety of petroleum products are almost limitless, when we begin to examine into the naphtha specialties. Refined oils are of many grades, from the ordinary low test oil of export to the 300° fire test oil used by certain railroads, or from the standard white or yellow oil in color to the beautiful water-white as clear and brilliant as spring water. But the varied grades are quite similar in constitution and are put to practically the same uses. With naphthas it is different. The products are unlike and the purposes served by them widely dissimilar. Naphtha as it comes from the crude stills is charged in a still quite like the steam still just described for driving out of oil distillates the more gaseous elements. In this the naphtha is distilled by steam heat, the same as refined oil distillate, except that in the case of naphtha a much larger proportion of the contents of the still is driven out in the form of vapor. The most volatile portions are seldom condensed. We refer to rhigolene, so named by Dr. Bigelow, and chymogene, which are gases at ordinary temperatures, are liquefied only at low temperatures, and are held as liquids only under pressure. They have a specific gravity of 0.625 and boil at 65° Fahr. They have been used as anæsthetics for surgical operations, really freezing the parts to which they are applied. They also serve as substitutes for ammonia in engines for artificial refrigeration, their evaporation being so rapid that a temperature of 19 degrees below zero Fahrenheit has been obtained.

The next heavier product is known as gasoline, used very generally in machines for carburetting air to make illuminating gas for dwellings and factories. This product is also employed in lamps for street lighting.

Then follows stove naphtha, used for heating and cooking in a great variety of stoves especially constructed for this purpose, a trade already of large magnitude and deservedly increasing with remarkable rapidity,

winning its own way as an economical and comfortable means of cooking during the extreme heat of our western and southern summers.

A large proportion of the yield next secured is known as gas naphtha and is delivered to gas works of cities, being now the staple article from which illuminating gas is made.

These grades, and others especially made for the purpose, are used in paints and varnishes, because of the readiness with which they evaporate, and in the manufacture of floor cloths, patent leather, etc.

Many of the naphtha products have to be treated with chemicals to deodorize them. This is done in an agitator similar to that employed for treating refined oil distillate, but care has to be exercised to avoid large losses by the evaporation of the more volatile constituents when the liquid is agitated. It was, therefore, for some time the practice to effect this agitation by some mechanical contrivance in the way of a vertical revolving shaft fitted with arms, but now an air blast is used as in the case of refined oil. Additional distillation and other manipulations are also needed to finish some of the products designed for particularly delicate uses.

PRODUCTS FROM RESIDUUM.—Naphtha is the by-product lighter than refined oil produced in its manufacture. Residuum is the corresponding heavier product. It is the residue of the crude left in the still after the vapors making naphtha and refined oil distillates have been driven out. A by-product at the refinery, it becomes a crude product, or base of manufacture, when transferred to the paraffine works. The residuum is put into stills much like those used for crude petroleum, except that they are smaller and as the fire used is much hotter and the contained liquid heavier, they are built stronger. The charge is distilled to dryness, leaving a thick layer of coke or porous carbon in the bottom, of considerable value for the manufacture of carbon points for electric light lamps, for fuel and for many other purposes.

The distillation of residuum for the manufacture of oils and waxes is an industry by itself, requiring perhaps more skill and the use of much more complicated apparatus than the production of refined oil from crude. Tar stills are often provided with a preliminary condenser in the form of cast or wrought iron eight or ten inch pipe suspended above the still or condenser box in the air, the temperature of the atmosphere being sufficient to liquefy a considerable portion of the vapors. These air condensers are provided with proper outlets to draw off the condensed oil, which, of course, is the heavier part of the vapors, the rest of the vapor passing into a condenser, similar to a refined oil condenser, immersed in water. The first part of the distillate run from tar is generally found to be sufficiently light in gravity to be sold for gas-making purposes, or to go back to the refinery to be re-run for the production of refined oil the same as crude. After this is run off, paraffine oil distillate steadily pours forth from the end of the condenser worm,

EMERY MANUFACTURING CO., BRADFORD.

increasing in gravity and deepening in color until the still is empty. This distillate passes through a treating process much like that employed for refined oil and naphtha, except that it is more severe as the product is so much heavier, requiring longer time, more chemicals and greater care. From this point the manipulation is in the hands of the producer of wax, as the production of the multiform paraffine lubricating oils is the result of methods used to secure the wax. The work is so distinctive and the products so unique that it seems best to consider this subject in a section by itself.

Paraffine Wax.—Fossil paraffine or Ozokerite or "earth wax" has been found for many centuries in enormous quantities in different parts of Europe, but particularly Galatia. It was mined the same as other mineral deposits, purified and made into candles. Peckham tells us that in 1875, there were 22,000 tons taken from the foot hills of the northern slopes of the Carpathian mountains in Galatia and certain mines of Moldavia. Its name was given it by the chemist Carl Reichenbach, who discovered in 1830, that it was the result of the distillation of several organic bodies at high temperatures. He named it paraffine because of its remarkable resistance to chemical action, the literal meaning of the word being "little, or too little, affinity." As found in the natural state in these European fields, it appears to be a mass of brown, greenish or yellow scales, which when softened can be molded like beeswax. As made from petroleum, it is in the form of a translucent crystal, of a light yellow to bluish white color, according to the grade of distillate from which it is made and the chemical treatment to which it has been subjected.

It is of interest to find that paraffine was a product of commercial importance long before petroleum oils were manufactured. Crew quotes at length from Prof. F. H. Storer's reference to patents secured by the French chemist Selligue, in 1839 and 1845. We will simply enumerate the products he described as made from bituminous shale, to show how long before the beginning of the petroleum industry, methods almost identical with those that are now so generally employed were known and tried. He used both sulphuric acid and soda for treatment and employed superheated steam in manufacture. The products of his distillation were:

1. A white, almost odorless, very limpid mineral oil that could be used for illuminating purposes in suitable lamps.

2. A light lemon-colored oil, perfectly limpid, almost odorless, that could be burned in ordinary lamps having an elevated reservoir, and, when mixed with animal or vegetable oil, did not easily congeal when subjected to cold.

3. A fat mineral oil containing a little paraffine and peculiarly adapted to lubricating machinery.

4. Red coloring matter extracted from the three oils just mentioned.

5. White crystalline paraffine, which needed but little treatment to be fit for making candles.
6. Grease for lubricating machinery.
7. Black pitch for preserving metals, woods, etc.
8. An alkaline soap.
9. Sulphate of ammonia.
10. Manure from the coke.
11. Sulphate of alumina from the coke.

It is also interesting to remember that the valuable paraffine products extracted from petroleum were not found as the result of a search for them, but in an effort to remove from paraffine lubricating oils an element that made them gum up the machinery on which they were used. Samuel Downer, in his experiments in this direction, chilled the oil until it solidified and then pressed it, the solid that was eliminated being wax.

The practice to-day is to slowly chill the heavy oil coming from the distillation of tar by means of a bath of a solution of sodic, or magnesic, chloride, brought to the required temperature by the use of an ammonia refrigerating apparatus. The semi-solid mass is then subjected to hydraulic pressure at a temperature of from 30° to 40°. The cakes remaining after pressing out the oil from the wax are then melted and the wax allowed to again crystallize, to be subjected to a much greater pressure at a higher temperature, the aim being to expel as much of the oil as possible. The absence of the wax from the expressed oil gives it what is called a good "cold test," that is, the quality of withstanding a considerable degree of cold without developing paraffine crystals to clog the machinery upon which it may be used as a lubricant. The absence of the oil from the wax makes it dry instead of greasy when put to its various uses. The temperature to which the distillate is chilled before it is pressed determines what is known as the "melting point" of the wax, that is, the temperature at which it liquefies.

For many purposes, particularly for the manufacture of the finer grades of candles, wax that has undergone even the several purifying processes already described has to be still further freed from oil. This is done by washing it with naphtha or heating it almost to the point of melting, to drain the oil out of it, and then chilling it once more after a slight chemical treatment. In this way a most beautiful, hard, colorless article is secured, which is practically pure crystalline paraffine. It is put to a large number of uses, but its greatest consumption is in the manufacture of candles, where it is gradually displacing all other materials.

REDUCED LUBRICATING OILS.—The paraffine oils just described are the result of the distillation of the residuum or reduced product left behind in the still when distilling crude petroleum. Other lubricating oils, having different characteristics from those of paraffine oils, and therefore better adapted to certain uses, are made more directly from the crude

EMERY MANUFACTURING CO., BRADFORD.

by a reducing process. The lighter elements in the crude are driven off, generally with great rapidity, their quality being ignored in the effort to obtain a proper residue in the still. At some works vacuum stills are employed for this purpose, that is, stills built sufficiently strong to admit of their standing a partial vacuum put upon them by the aid of a pump during the run to accelerate the withdrawal of the vapors liberated from the crude by the heat. A refinery making these reduced products is generally known as a lubricating oil works. The student of the methods at such factories finds himself in a labyrinth of processes and surrounded by multiform products. The extremes of refined oils and of waxes are touched, while between lies a wilderness of products of all kinds designed to meet the varied tastes, whims or needs of consumers. Some of the oils are mixed with the pressed distillate obtained in producing wax, some are mixed with various animal or vegetable oils, and some are purified or decolorized by filtration through animal charcoal. Each process is a separate art. To become proficient in it requires years of experience. And each process has devoted to it intricate and expensive machinery, quite beyond our limits, in such a report as this, to describe.

The advent of petroleum as a lubricant was almost as important as its advent as an illuminant. Its cheapness is reflected in the reduced costs of many lines of manufacture, where the friction of whirling machinery has to be overcome; not to mention its almost exclusive use for the lubrication of the rolling stock of railroads. Improvements in manufacture and more accurate methods of testing have removed the objections offered to the first products put on the market, namely, disagreeable odor and danger from fire, either because the oils threw off inflammable vapors or themselves ignited in spontaneous combustion when heated by friction. What requirements should be met in a satisfactory lubricating oil are admirably summarized by Prof. R. H. Thurston, of Cornell University, in his *Treatise on Friction and Lost Work in Machinery and Mill Work:*—

1. Enough body, or combined capillarity and viscosity to keep the surfaces between which it is interposed from coming into contact under maximum pressure.

2. The greatest fluidity consistent with the preceding requirements, *i. e.*, the least fluid friction allowable.

3. The lowest possible co-efficient of friction under the conditions of actual use, *i. e.*, the sum of the two components solid and fluid friction should be a minimum.

4. A maximum capacity for receiving, transmitting, storing and carrying away heat.

5. Freedom from tendency to decompose or to change in composition, by gumming or otherwise, on exposure to the air or while in use.

6. Entire absence of acid or other properties liable to produce injury of materials or metals with which they may be brought in contact.

7. A high temperature of vaporization and of decomposition and a low temperature of solidification.

8. Special adaptation to the conditions as to speed and pressure of rubbing surfaces, under which the unguent is to be used.

9. It must be free from grit and from all foreign matter.

Many grades of petroleum oil are beyond question made to-day suitable to some one of the great variety of bearings upon which they are used which meet the above requirements far better than any other lubricant.

This section would be incomplete without a passing reference to the crude oil, secured in a few places, that can be used for lubricating purposes in its natural state: the well-known Franklin oil, a first sand crude obtained in the neighborhood of the city of Franklin; the Smith's Ferry crude of Beaver county, and the natural West Virginia oil from the region about Parkersburg, in that state. These grades all come from shallow wells, and have the peculiarity of not chilling except at very low temperatures Some of them do, however, thicken as they are cooled to the freezing point of water or below, but without depositing paraffine; it being now, we believe, a conceded fact that paraffine in crystalline form cannot be produced in crude oil by chilling but can be obtained only by first converting the crude into distillate. It is only for heavy lubrication that these natural oils are used, and in this work they are being supplanted by manufactured products which imitate their desirable qualities to a great extent—so much so, that a large proportion of the goods sold as these natural crudes are the result of skillful manufacture

EXPORT AND DOMESTIC TRADE IN PETROLEUM PRODUCTS.

Export Trade.—Barrels.—Cans and Cases.—Shipments in Bulk.—Tank Steamers and Sailing Vessels.—Tank Cars.—Tank Wagons.—New York Produce Exchange Rules Regulating Exports.—State Laws Regulating the Sale of Petroleum Products.

Export Trade.—Petroleum has undoubtedly reached a wider market than any other product of American industry. Every quarter of the globe has been blessed by its beneficent light. Wherever commerce has made its way, petroleum has been taken as an article that finds ready sale. As has been said: "It is carried wherever a wheel can roll or a camel's foot be planted. The caravans on the Desert of Sahara go laden with Astral oil and elephants in India carry cases of Standard White. Ships are constantly loading at our wharves for Japan, India, and the most distant isles of the sea." Everything connected with this magnificent business is of interest. We have seen that a silent revolution in the industry took place when pipe lines for the transportation of crude were found practicable. Another revolution has been experienced during the last five years in the mode of carrying much of the finished oil exported. Until within this period all petroleum was delivered to foreign countries in either barrels or cases. To-day the transportation of oil in bulk is becoming very general, displacing to some extent, though not altogether, shipments in barrels, and to a lesser extent, shipments in cans. The making of these packages should be briefly described.

Barrels.—An excellent description of the manufacture, preparation and filling of barrels was given by Mr. Boverton Redwood, the official inspector of the London Petroleum Association, in his Cantor lectures before the Society of Arts, London, after a visit to America, a few years since, to familiarize himself more thoroughly with our products. When it is remembered that this outline describes the making of but one of several distinctly different kinds of packages for conveying petroleum to distant markets, that it is of course entirely separate from the manufacture of the oil, but a necessary adjunct to the success of the industry, the ramifications of the manufacture of petroleum can be comprehended. We quote the following from his lecture:—

"The oak staves are purchased ready jointed and seasoned in Michigan, and the barrel heads are brought to the works ready glued up. The first operation in barrel making consists in fitting the necessary number of staves together in a thick wrought iron ring encircling their lower ends. This is an operation requiring some experience and judgment. The embryo barrel is then placed in an iron cylinder and steamed, whereby the wood is softened. The staves are next encircled by a wire rope connected with an engine, and are thus bent into shape and drawn

together, a second strong iron hoop being slipped on their upper ends to hold them in position. The barrel is then 'fired' by burning some readily combustible material in the interior, and the curvature of the staves thus rendered permanent. A number of extra temporary iron hoops of great thickness are next slipped on, and drawn toward the bulge of the barrel by means of an ingenious arrangement of iron hooks or claws actuated by steam power. The final operation performed upon the staves consists in placing the barrel in a lathe, paring off the rough ends, and cutting the grooves for the heads.

"The barrel is then ready to receive the heads and to be hooped. The hoops weigh collectively about 12 pounds, and the total length of iron required for a set is 443½ inches, so that putting the out-turn of finished barrels from one factory at 10,000 per day, we have a length of about 70 miles of hoop iron (weighing about 55½ tons) used daily.

"In order to render the barrels capable of holding their fluid contents without leakage, they are coated internally with glue, about one pound of glue to three barrels being required. The glue solution is poured into the barrels hot, the barrels bunged up, and rotated so that the solution coats the entire surface, the surplus being afterwards drained out. There is some pressure of steam in the barrel during the operation, and a leak is thus at once shown. The barrels finally receive a coating of the well known blue paint on the staves, and white paint on the heads. Oil barrels returned to be refilled are often cleaned externally by an arrangement of rapidly revolving wire brushes, are steamed out, reglued and repainted.

"Before the barrels are filled, the hoops require 'driving' to take up the shrinkage of the wood. This was formerly done exclusively by hand, but Mr. Hopper has invented a successful machine for doing this by steam power. In this apparatus the barrel stands on a platform arranged like an inverted steam hammer, and on turning on the steam it is brought, with a succession of blows, against a number of hinged stops, which closely encircle the barrel and on which the hoops strike. With one such machine the hoops of 2,000 barrels can be driven in ten hours by one man and two boys—an amount of work which formerly entailed the hand labor of ten men.

"The barrels are filled from a rack provided with a series of pipes connected with a barrelling tank. Each pipe has at its exit end a float connected with a valve, which shuts off the oil when the barrel has been filled to within one gallon of its contents. The shives with which the barrels are closed are of wood and are put in with glue. A package which remains perfectly tight and free from leakage as long as it is handled carefully, and the continuous skin of glue remains intact, is thus produced."

As already stated, shipments heretofore made in barrels to many ports are now being made in bulk by both sailing vessels and steamers. These shipments and the vessels carrying them will be referred to later.

CANS AND CASES.—Shipments of oil to warm climates are made exclusively in cans, as barrels, though cheaper per gallon, are liable to develop leaks when exposed to decided changes in temperature. Deliveries to the more distant ports of China, Japan, India, Australia, the East Indies, and South America, are still, and probably will for many years continue to be, made in these packages, as bulk vessels cannot

afford to engage in that trade because no return cargoes can be secured, so that the whole expense of the round trip would have to be borne by the load of oil carried out, the steamer returning empty. Cases can be packed close together, making a solid mass, with no loss of space in a ship's hold. In this respect they have a decided advantage over barrels.

The cans are of rectangular form, holding five American (or four English imperial) gallons, and are put by twos into wooden rectangular boxes. The outside dimensions of a case are about $20\frac{3}{4}$ inches long by 15 inches high and $10\frac{1}{2}$ inches wide. This makes a very convenient package for handling, the weight of the case with the cans full of oil being about 80 pounds. The manufacture of the can and of the case are distinct industries, the former requiring delicate and expensive machinery and a large force of skilled mechanics. Most of the raw material used in making the cans, including the tin plate, is imported from England, the major part of the heavy duty imposed being returned as drawback by the government when the package of oil is exported. This is also true of the case, much of the lumber used coming from Canada, a duty being paid when it is brought into this country, and refunded on such portion of the lumber as is made up into the case and shipped abroad. Each can is fitted with a handle of wire or tin and a screw top from which the oil may be poured when the consumer wishes to use it. An oil case with its two cans is a package that reflects great credit on the skill of American inventors.

SHIPMENTS IN BULK.—A considerable portion of our domestic trade in refined oil and some portion of the trade in lubricating oils has, for many years, been done in bulk. By this we mean that no package is used for the product as it passes from the refinery to the consumer. Its course is somewhat as follows: When finished at the refinery it is pumped into large storage tanks. From these it is delivered in bulk to barges or tank cars. These carry it to the stations where it is pumped again in bulk, into tanks, from which it is delivered to tank wagons. These serve it in bulk to the dealers' tanks, to be by them delivered to the customer, or, in some cases, direct from the tank wagon to the consumer.

But this mode of transportation for export trade is of recent growth. When it was suggested that there were economies to be secured by carrying oil abroad in bulk, that all of the weight transported would be oil and freighting the package would be saved, not to mention the expense of bringing back the empty barrel to be used again, which was largely practised, as the barrels had become a burden to the foreign buyer, the contents being consumed and the packages left on his hands, numerous objections were presented. Some of them were, the great cost of providing vessels for the purpose, the small earnings on the investment because the return voyage must be made without cargo, the danger attending the enterprise from fire, and from loss of both vessel

and cargo by foundering, and the damage to the oil by changing its test or color through the extra handling. With our knowledge of what has been accomplished, we are amused to read in Prof. Peckham's report for the Tenth Census, published only eight years ago, a long quotation from the *Oil and Drug News*, referring to the plan of changing the Red Star Line steamship "Vaderland" into a bulker to carry petroleum. A part of the quotation reads:—

"Inquiry among petroleum men and shipping merchants in this city elicited the general opinion that the idea is not considered practicable. Said one well-known oil inspector: 'It is my opinion that the system will not work. It has been tried three times on sailing vessels during the past eight years, and each time the vessel was lost. * * * * * * Besides, what is the advantage of the system, anyway? The vessel must return in ballast, and it might as well bring back barrels, which, under the present system, are used over and over again, but under the proposed method would not be needed in the export trade.'

"Messrs. — ——, the well-known shipping merchants, state that about eight years ago one of their vessels was fitted up with tanks for transporting oil in bulk. She proceeded on her journey and was never heard from. Her loss was undoubtedly due to her mode of carrying petroleum. Another shipping merchant stated that he believed the idea to be impracticable. It might be possible to make the tanks strong enough to prevent the escape of the vapor of the oil, but all previous experiments had proved failures, and there was no reason to suppose that this would succeed.

* * * * * * * * *

"The 'oil in bulk' movement does not meet with favor among practical exporters. They say that it cannot be carried out successfully."

The change in the mode of transportation when it had once begun was carried forward with startling rapidity. The "Vaderland" was not a success as a tank steamer. In 1886 two others were fitted up, the "Crusader" and the "Andromeda." The former was filled with a large number (45 in all) of cylinder tanks of different sizes, averaging in capacity 125 barrels, making the total capacity of the ship about 275,000 gallons. The "Andromeda" was provided with rectangular tanks, 72 in number, making the total capacity about 685,000 gallons. Neither of the steamers made many voyages.

But when the thought was once fairly presented, it soon became apparent that mechanical construction only stood in the way of making the change. Sailing vessels carried from 5,000 to 8,000 barrels each, and made about two and one-half to three trips per year; bulk steamers could be built to carry 20,000 to 30,000 barrels, or three times as much as a sailing vessel, and make seven to nine trips per year, or three times as many as a sailing vessel. The result has been that last year as many as fifty-nine different tank steamers carried oil from the United States abroad, and fully seventy-six percentage of the total exports of crude and refined oil, other than those in cases, were made in bulk.

Some of these steamers are "converted," that is, turned into bulk

OIL TANK STEAMER.

boats, although built for other uses. They can generally be distinguished by having their boilers and engines amidships, instead of, as in the case of the vessels built for this trade, aft, for greater safety. But many of the tank steamers are constructed especially for this service. They are models of marine architecture. They are built entirely of iron, including the decks. When loaded the whole body of the vessel is filled with oil, the ship's structure forming the necessary receptacle, the liquid occupying all the space to the "skin" or iron of the sides and bottom. This is a great improvement over such form of construction as that of the "Crusader" and the "Andromeda," already referred to, decreasing the cost of transportation by increasing the carrying capacity of the vessel, there being no unoccupied space between the tanks, and decreasing the risk of fires and explosions, as these empty spaces gave room for the accumulation of gas. Both these objections held true against the style of construction adopted later of a double bottom, the bottom of the oil tanks being elevated a short distance above the actual bottom of the ship. The tank ships as now built have a longitudinal and numerous transverse bulkheads, which, with the stringers and beams put in to prevent the slightest straining, make them, from a structural point of view, undoubtedly the safest and strongest vessels in the mercantile marine. We find a clear and comprehensive description of one of the more recently built steamers, the "Charlois," in *The Marine Transport of Petroleum*, by George Herbert Little, an English naval architect:—

"This vessel is 310 feet long, 39 feet beam, and 25 feet 3 inches deep and is capable of carrying upwards of 3,500 tons of petroleum, besides bunker coal, on a moderate draft.

"The requisite subdivision into eight tanks of moderate size is obtained by the introduction of nine thwartship bulkheads, which are very heavily stiffened and made extra thick to withstand the pressure due to any one tank being full while the others are empty. In addition to these there is a longitudinal bulkhead running the entire length of the oil compartments in the center of the ship, which further subdivides each tank into two. Wells, or water spaces, are formed at each end of the oil compartments, which are filled with water when the vessel is loaded with oil, and thereby isolate the oil from the rest of the ship and boiler room, to prevent risk of fire. Each tank is provided with a smaller tank above, running up through the 'tween-decks to the upper deck, which is fitted to allow for the expansion and contraction of the oil, due to difference in temperature, without permitting the oil to ever fall below the level of the top of the tank proper, which is essential to the vessel's stability at sea. It is usual to carry these expansion tanks about half full of oil. The expansion tanks also serve the purpose of giving access to the tanks, proper manholes and Jacob's ladders being provided. A special feature in this vessel, which the designers had particularly in view, is the fact that she could, with very slight alterations, be used for ordinary cargoes; the expansion tanks being arranged conveniently, and of extra size, for this purpose; this is, we think, an important point. The machinery and boilers are placed close aft, and

clear of the oil compartments, and the saloon and officers' and engineers' cabins and gallery, are abaft this, and therefore well clear of the tanks. The crew are berthed in the forecastle, and there is a long bridge amidships, with a shade or awning deck, connecting it to the poop. The shade deck was specially introduced by the designers to make the vessel more seaworthy, as she is employed in the Atlantic trade and this considerably reduces the amount of exposed deck. The internal fittings of this vessel are most complete, and, as a further precaution against fire, she is lighted throughout by electric light on the incandescent principle, the engines and dynamos being placed in the engine room directly under the control of the engineers. There are also steam heaters for all the cabins and the crew. Two powerful pumps are fitted in the 'tween-decks with very complete piping arrangements, each pump being capable of discharging the entire cargo of oil in thirty hours. As pointed out, there is no double bottom for water ballast, but tanks are provided at both ends for trimming purposes. For ballasting the ship when eight, two or more of the oil tanks are run up with water, special means being provided for this purpose, and when so laden the vessel is much steadier at sea than if carrying ballast in the ordinary double bottom; and, as these vessels have to make one out of every two trips across the Atlantic, light ship, this is very important."

Experience has suggested some minor improvements since the "Charlois" was built. The vessels constructed later have somewhat greater carrying capacity. The expansion tanks are not so large, but extend the whole length of the oil tanks they are designed to relieve. The strength of the hull has been still further increased by the addition of another deck or horizontal partition running through the oil tanks, dividing each into an upper and lower tank. This iron partition, with its braces, adds materially to the stability of the ship both when empty and full.

The change from barrel to bulk transportation means large economies in many ways. Before it was made, oil was filled into barrels, each package weighed by itself, then rolled to the dock front and hoisted up over the side of the ship, lowered into the hold and stowed away. Each operation required considerable manual labor. The sailing vessel, for a month or six weeks, was then exposed to the delays and vicissitudes of an ocean voyage, arriving at length at its destined port. Here she was unloaded, a barrel at a time, and the oil stored away in packages to be held until used, subject to loss from leakage and serious damage in appearance. By the new method of transportation, a steamer comes to the wharf, and the oil is pumped from the refinery storage into her tanks with great rapidity; the largest of the ships being loaded in from 10 to 12 hours even though they hold four or five times as much as the sailing vessels of a few years ago. A voyage of two weeks and perhaps a few days, the time being subject to very close calculation, brings the cargo to the foreign port. Here it is unloaded with the same despatch that was used in loading; the oil being pumped into large storage tanks on shore, in which it is held with-

out loss or damage until needed; the steamer starting immediately on her return trip. Not a moment of time is lost and no item of extra expense incurred.

Tank Steamers.—We append a table giving the names of the tank steamers that were engaged in carrying petroleum from the United States in 1892. There were fifty-nine in all. Those that carried cargoes from Philadelphia are designated by a star. The table shows the tonnage of each ship, her capacity to carry bulk oil, her length, breadth of beam and depth, and the flag under which she sails. A second table gives similar information in regard to the bulk sailing vessels that took cargoes last year from the United States.

[TABLE FF.]

LIST OF STEAMERS CARRYING PETROLEUM IN BULK FROM THE UNITED STATES TO FOREIGN COUNTRIES DURING THE YEAR 1892.

NAME OF STEAMER.	OIL CARRYING CAPACITY.		REGISTERED TONNAGE.		DIMENSIONS OF STEAMER. (English feet).			Flag carried.
	In gallons.	In tons.	Gross.	Net.	Length.	Beam.	Depth.	
*Allegheny,	1,200,000	3,480	2,914	1,910	320	42	26	British.
American,	1,540,000	4,450	3,897	2,927	345	44	27	Dutch.
*Apscheron,	650,000	1,800	1,864	1,441	271	37	22	Belgian.
*Aral,	1,260,000	3,655	2,826	2,160	310	40	28	British.
*Astrakhan,	1,500,000	4,350	3,438	2,236	330	42	28	do.
*Astral,	960,000	2,800	2,249	1,465	281	38	25	do.
*Bayonne,	1,400,000	4,060	3,294	2,150	330	42	28	do.
*Beacon Light,	1,260,000	3,655	2,763	2,107	311	40	28	do.
*Bear Creek,	1,100,000	3,195	2,411	1,573	294	37	26	do.
*Bremerhaven,	1,350,000	3,920	3,393	2,179	339	42	26	do.
*Brilliant,	1,435,000	4,165	3,162	2,411	319	42	29	German.
*Broadmayne,	1,100,000	3,195	3,095	1,995	334	44	24	British.
Burgerm. Peterson,	1,275,000	3,700	2,794	2,090	310	40	28	German.
*Cadagua,	1,020,000	2,960	2,394	1,858	305	39	26	Spanish.
*Caucase,	720,000	2,090	1,643	1,321	250	35	24	Belgian.
Charlois,	1,200,000	3,480	3,002	1,978	310	41	27	British.
*Chester,	1,175,000	3,410	2,834	1,872	311	39	25	do.
*Christine,	850,000	2,465	2,293	1,642	280	37	25	Danish.
*Circassian Prince,	980,000	2,845	2,243	1,486	272	38	26	British.
Darial,	1,200,000	3,480	2,767	1,814	310	40	28	do.
Diamant,	1,500,000	4,350	3,525	2,270	330	43	31	German.
*Elbruz,	1,230,000	3,570	2,715	2,101	310	40	28	British.
*Elise Marie,	1,425,600	4,135	3,194	2,424	318	41	22	German.
*Energie,	1,225,000	3,555	2,765	2,074	310	40	28	do.
*Geestemunde,	1,255,000	3,640	2,750	2,101	310	40	28	do.
*Glückauf,	1,025,000	2,975	2,597	1,881	300	37	30	do.
Gut Heil,	1,200,000	3,480	2,737	2,096	310	40	28	do.
*Hafis,	800,000	2,320	2,123	1,621	270	36	21	do.
*Helgoland,	1,100,000	3,195	2,397	1,563	294	37	26	do.
*Kasbeck,	1,210,000	3,510	2,707	2,099	310	40	28	British.
*La Campine,	1,100,000	3,195	2,542	2,007	310	39	26	Dutch.
*La Flandre,	900,000	2,610	1,979	1,509	270	37	25	do.
La Hesbaye,	1,155,000	3,350	2,701	1,948	300	39	29	do.
*L'Oriflamme,	1,120,000	3,250	.....	.....	343	42	28	British.

*Took cargo from Philadelphia in 1892.

[TABLE FF.]

LIST OF STEAMERS CARRYING PETROLEUM IN BULK FROM THE UNITED STATES TO FOREIGN COUNTRIES DURING THE YEAR 1892.—*Concluded.*

NAME OF STEAMER.	OIL CARRING CAPACITY.		REGISTERED TONNAGE.		DIMENSIONS OF STEAMER (English feet).			Flag Carried.
	In gallons.	In tons.	Gross.	Net.	Length.	Beam.	Depth.	
*Lucerna,	1,500,000	4,350	3,342	2,072	330	42	28	British.
*Lumen,	1,100,000	3,195	2,357	1,554	294	37	26	do.
*Manhattan,	1,400,000	4,060	3,300	2,153	330	42	21	do.
Mannheim,	1,500,000	4,350	3,507	2,257	330	43	29	German.
*Mineral,	500,000	1,450	1,304	849	249	30	23	British.
*Minister Maybach,	1,175,000	3,410	2,486	1,955	285	40	24	German.
*Ocean,	1,170,000	3,400	2,835	1,872	310	39	25	British.
*Orange Prince,	845,000	2,450	1,808	1,214	260	36	25	do.
*Oural,	950,000	2,755	2,421	1,634	270	39	21	Belgian.
*Paula,	1,190,000	3,455	2,675	2,160	285	40	30	German.
*Petriana,	600,000	1,750	1,672	1,086	260	34	21	British.
*Petrolea,	950,000	2,750	2,331	1,596	292	37	25	do.
*Phosphor,	880,000	2,555	2,023	1,326	270	37	25	do.
*Prudentia,	1,185,000	3,440	2,730	1,791	312	40	27	do.
*Robt. Dickinson,	790,000	2,295	1,978	1,297	278	35	22	do.
*Rocklight,	1,285,000	3,730	3,225	2,119	312	40	29	do.
*Russian Prince,	1,200,000	3,480	2,716	2,107	310	40	28	do.
*Sophie,	625,000	1,815	1,362	1,114	235	33	23	German.
*Standard,	1,260,000	3,655	2,765	2,110	310	40	28	do.
*Tancarville,	950,000	2,750	2,336	1,541	292	37	25	British.
*Vindobala,	675,000	1,960	1,744	1,134	261	34	21	do.
*Ville de Donai,	720,000	2,090	1,872	1,406	265	37	23	French.
*Weehawken,	1,260,000	3,655	2,784	2,101	310	40	28	British.
*Wild Flower,	1,020,000	2,960	2,650	1,745	300	40	18	do.
Wilkommen,	1,270,000	3,685	2,891	2,297	315	41	24	German.

*Took cargo from Philadelphia during 1892.

[TABLE GG.]

LIST OF SAILING VESSELS CARRYING PETROLEUM IN BULK FROM THE UNITED STATES TO FOREIGN COUNTRIES DURING THE YEAR 1892.

NAME OF VESSEL.	OIL CARRYING CAPACITY.		REGISTERED TONNAGE.		DIMENSIONS OF VESSEL (English feet).			FLAG CARRIED.
	In gallons.	In tons.	Gross	Net.	Length.	Beam.	Depth.	
*Einar.	230,000	665	. . . . .	625	154	33	19	Norwegian.
Hainaut.	870,000	2,525	. . . . .	1,709	249	40	22	Belgian.
*Patagonia. . . .	500,000	1,450	. . . . .	1,200	190	38	22	Norwegian.
*Rolf.	430,000	1,250	. . . . .	1,211	201	36	23	do.
*Unionen.	875,000	2,530	. . . . .	1,729	249	40	22	do.
*Ville de Dieppe. .	641,000	1,860	. . . . .	1,279	217	36	21	French.

BULK BARGES.—There are several bulk steamers, smaller of course than the ocean steamers, engaged in our coastwise domestic trade. But before either the ocean or coastwise steamers were put into service, many bulk barges were employed moving refined oil and naphtha about the seaboard harbors. This mode of transportation has grown in favor, and, to-day, there is a large fleet of such barges, with their attendant steam tugs to furnish motive power, employed not only in harbors but in the carrying trade for considerable distances along the coast and up the larger rivers. The barges are of wood or iron, some large enough to hold 500,000 gallons, the whole space of the hull being divided into tanks for the oil. Simpler in construction than bulk ocean steamers, they make it possible to move large quantities of oil with dispatch and economy.

TANK CARS.—The value of this mode of transportation became apparent in the early days of the petroleum industry; but in their construction, as in other branches of the business, there has been an evolution. The first cars consisted of two wooden tubs or vats of 2,000 gallons capacity each, set on an ordinary platform car. In 1872, horizontal cylinder tanks of iron were tried. Each held about 4,000 gallons. The size has gradually been increased by lengthening the cylinder and increasing its diameter until now many of the cars carry 8,000 gallons each. Cars holding this quantity are about thirty-two feet in length and six feet in diameter. The tank is made of quarter-inch steel and has on the top a dome, similar to a still dome, to care for the expansion of the oil. In the bottom of the car is an outlet valve with proper contrivances to admit of connecting lines through which to empty the tank. The total number

*Took cargo from Philadelphia in 1892.

of tank cars employed in the United States is between nine and ten thousand.

Tank Wagons.—The delivery of oil by tank wagons is extending the idea of bulk transportation to its farthest limits. The wisdom of carrying in this way the huge quantities, which a steamer or a train of tank cars convey for considerable distances, may be apparent; when the advantages of moving the smaller quantity which a tank wagon will hold, for the short trip it can make, may not be clear. That there must be economy or other advantages in this method of transportation is indicated by the strong foothold it has gained, as it is quite generally adopted in our larger cities and towns.

A tank wagon consists of a horizontal cylinder of steel of about three and one-half feet in diameter, and eight feet in length, mounted on four wheels similar to those used on heavy trucks. The capacity varies from 250 to 1,000 gallons; the large sizes being used in cities having paved, level streets; the smaller sizes, in the hilly outlying districts, or in sections where the trade is limited. A few of the larger wagons are rigged for three horses. Each tank has some sort of a manhole on top, for the admission of the oil; and some one of the various designs of outlet cocks and measuring devices, for drawing out the oil. These, with the receptacle for the cans for carrying the oil into stores, the driver's seat, and in fact all of the minor features of the plan of the wagons, differ in different cities. In some places the wagons leave the oil at customers' houses, but usually are employed to supply the stores in which oil is sold.

Rules Regulating Exports of Petroleum.—Contracts for the sale of petroleum for export are made subject to the rules of the New York Produce Exchange. This is true of deliveries to be made from Phila delphia and Baltimore as well as from the port of New York. We append these rules as now in force.

"Refined petroleum shall be Standard White or better, with a burn-test of 110° Fahrenheit or upward, and of a specific gravity not below 44° Baumé, United States Dispensatory Standard.

"The burning test of refined petroleum shall be determined by the use of the Saybolt Electric Instrument, and shall be operated in arriving at a result as follows: In 110° and upwards, the flashing points, after the first flash (which will generally occur between 90° and 95°), shall be taken at 95°, 100°, 104°, 108°, 110°, 112° and 115°.

"In 120° and upwards, after first flash, at 100°, 105°, 110°, 115°, 118°, 120°, 122°, and 125°.

"In 130° and upwards, every five degrees until burning point is reached.

"When refined petroleum is sold in bulk, the quantity shall be ascertained by measurement on the decks of the tank boats.

"Refined petroleum shall be delivered in blue, well-painted barrels, with white heads. Barrels shall be well glued and filled within one or two inches of the bung.

"Refined petroleum in barrels shall be sold by weight, at the rate of six and one-half pounds net to the gallon.

"The tares of refined petroleum in barrels shall be weighed by half pounds and gross weight by pounds.

"The gross weight of packages for refined petroleum shall be not less than 360 lbs., nor more than 415 lbs., and the actual gross weight shall be plainly marked thereon.

"Barrels shall be made of well-seasoned white oak timber, and shall be hooped not lighter than as follows: Either with six iron hoops, the headhoop $1\frac{3}{4}$ inches wide, No. 16 gauge English standard, the quarter hoop $1\frac{1}{2}$ inches wide, No. 17 gauge, and the bilge hoop $1\frac{3}{4}$ inches wide, No. 16 guage; or, with eight iron hoops, the head hoop $1\frac{3}{4}$ inches wide, No. 17 gauge, the collar hoop $1\frac{1}{4}$ inches wide, No. 17 gauge, the quarter hoop $1\frac{1}{2}$ inches wide, No. 18 gauge, and the bilge hoop $1\frac{1}{2}$ inches wide, No. 18 gauge. But all old barrels of which the gross weight is less than 395 lbs. may be hooped with six iron hoops $1\frac{1}{2}$ inches wide, excepting the chime hoop, which shall be $1\frac{3}{4}$ inches wide.

"Buyers may test, at their own expense, the correctness of the gross weight, or gauge of the whole, or part of any lot delivered, and the average shortage found on a portion of not less than ten per cent. shall be taken as the average amount to be deducted from the lot.

"The tare shall be plainly marked upon each barrel before it is filled. Buyers may test the accuracy of the tare so marked to the extent of five per cent. of the lot, and the average difference between the tare thus ascertained, and the marked tare on the barrels tested shall be accepted as the average difference on the entire lot. Any excess of tare so discovered shall be allowed buyer.

"NAPHTHA.—Naphtha shall be water white and sweet, and of gravity of from 68° to 73° Baumé.

"When naphtha is sold in bulk the quantity shall be ascertained by measurement on the decks of the tank boats.

"Naphtha in barrels shall be sold by weight, at the rate of five and three-quarter pounds net to the gallon.

"Barrels containing naphtha shall be painted blue with white heads, and be well glued.

"Naphtha shall be weighed, and may be tested by the buyer, as provided in the foregoing rules relating to refined petroleum.

"RESIDUUM.—Residuum shall be understood to be the refuse from the distillation of crude petroleum, free from coke and water, and from any foreign impurities, and of gravity from 16° to 21° Baumé.

"Residuum, when sold in barrels, shall be sold by weight at the rate of seven and one-half pounds net per gallon.

"Residuum shall be weighed, and may be tested by the buyer, as provided in the foregoing rules relating to refined petroleum.

"EMPTY BARRELS.—Unless otherwise stipulated, empty barrels shall be understood to have last contained either refined petroleum or naphtha.

"Barrels shall be classified according to the use for which they are fitted, as follows:

"First class shall include all barrels, which, if properly coopered, would be fit to carry refined petroleum or naphtha.

"Second class shall include barrels which are unfit for refined petroleum or naphtha, but which would, if properly coopered, be fit for crude petroleum.

"Third class shall include such barrels as are unfit for either crude,

refined petroleum, or naphtha, but which can be used for residuum, if properly coopered.

"When barrels, which would otherwise be first class, have been injured by sand, mould or water, they shall be placed in the second class.

"When barrels are sold as they run, the term 'as they run' shall be understood to refer to the condition as to the cooperage only.

"When barrels have been filled with crude petroleum, and steamed out after shipment to Europe, and used for refined oil, such packages shall be placed in the second class.

"All empty barrels must have six hoops, and be delivered in form, shooks or staves not being a good delivery.

"On re-inspection of rejected barrels, the buyer must receive the pay for such rejections as of the class designated by the inspector, and pay inspection on such as he decides were improperly rejected.

"Contracts and Deliveries.—All deliveries and contracts for delivery of petroleum and its products, under these rules, shall be of the production of the United States, unless otherwise specified, but refined petroleum made from crude oil of the district known as 'Lima' or oil made from crude oil of a similar quality or character, shall be excluded.

"All settlements of contracts for refined petroleum and naphtha shall be on the following basis: In barrels on 50 gallons; in bulk on 45 gallons. All settlements of contracts for crude petroleum shall be on the following basis: in barrels on 48 gallons; in bulk on 42 gallons.

"All cooperage shall be in prime shipping order. Tar and pitch barrels shall be excluded, except for residuum.

"Deliveries of petroleum and its products, sold in bulk, shall be made in yard, at refinery, or warehouse, free of expense to lighter, quality to be approved in the tank at the time of delivery.

"Deliveries of petroleum and its products, in barrels, shall be made in yard, at refinery, or warehouse, where sea-going vessels can load, or, if not, sellers to pay lighterage to vessel.

"The words, 'yard where sea-going vessels can load,' shall be understood to mean a yard at which vessels of at least 4,500 barrels capacity can complete loading.

"The presentation of an invoice, weigher's or gauger's return, a certificate of inspection of the oil, together with an accepted order on the warehouse, yard or refinery, shall constitute a delivery.

"No weigher's or gauger's return or certificate of inspection dated more than four secular days previous to the time of delivery shall be valid, and the said returns shall be verified on oath or affirmation when required.

"Petroleum and its products shall be held for three days from noon of the date of delivery order, free of storage and insurance. The party issuing the delivery order shall keep the goods covered by insurance during the three days; it being understood, however, that the responsibility of the said party shall only extend to due care in providing insurance, and not to any failure on the part of the underwriters to pay losses which may be sustained.

"Cargo contracts shall specify dates between which the vessel shall be ready for cargo, and also number of lay days vessels will have to load, and the term 'suitable to vessel' is hereby declared to have no reference to the time when vessels shall be ready, but to imply that when ready sellers shall deliver and buyers receive in such quantities that the vessel may be loaded in the specified lay days.

"If a vessel is not ready to receive her cargo on or within specified

dates, a written notice to the buyers from the sellers on or before the latest named date that they are prepared to deliver as per contract, shall be considered a delivery, so far as maintaining to the sellers all their rights in the contract, and the sellers may commence delivering any time thereafter on one days' notice, and may deliver until completed such approximate quantity per day as would serve to fill the vessel in the stipulated lay days.

"When goods are delivered to vessel by buyer's orders the acceptance of them by buyer's inspector shall be an acknowledgment that the goods are in accordance with the contract.

"When petroleum or its products are delivered to vessel by buyer's directions, the seller's risk shall end upon delivering the goods to the ship's tackle, and the seller may require evidence from the buyer that the goods are actually covered by insurance until paid for.

"When the capacity of the vessel exceeds or falls short of the amount specified in the contract, including the margin, then the specified amount shall be delivered. In determining the capacity of the vessel, barrels of fifty net gallons capacity in case of refined petroleum and naphtha, barrels of forty-eight net gallons capacity in case of crude petroleum, and barrels of forty-five net gallons capacity in case of residuum, shall be the basis for settlement.

"On option contracts, when not otherwise stipulated, it shall be understood that ten days' notice shall be given, five of which shall be within the delivery time specified. When the term 'flat' is used, it shall be understood to mean without notice.

"All deliveries shall be made before 5 o'clock p. m. Parties making original deliveries from warehouse or refinery, shall do so before 4 o'clock p. m.

"Each party to whom delivery is made on an option contract, and who intends to deliver the same out again on an option contract, shall note on the delivery order or memorandum attached thereto the time when received, and shall deliver the same out again within fifteen minutes. Parties having oil to receive, and which they intend to deliver out again on an option contract, but who are prevented from so doing by lack of time, shall make delivery by 10 a. m. of the next business day, and each party receiving on the extended delivery day shall note the time and deliver out as above specified. No delivery shall be allowed beyond 12 m. on the delivery day so extended. Parties holding delivery orders or memorandums over fifteen minutes, except for cause acceptable to the Committee on Petroleum, shall be liable to the party injured by such unjust detention to the extent of the damage.

"Payments for all deliveries made before 3 o'clock p. m., shall be in legal tenders or certified checks. Parties making deliveries after 3 p. m. cannot demand legal tenders or certified checks; such deliveries, however, will be good if made in comformity with rule, but without delivery order. Payments which are extended by reason of delivery after 3 p. m. shall be made as provided above before 12 m. of the next business day.

"When calls are made on option contracts, the original call shall be made by 10 o'clock in the morning, and parties on whom the call is made shall note on the call the time it was received; and if they recall on account of it, they shall do so within thirty minutes.

"When contracts mature on a Sunday or legal holiday, deliveries shall be made on the preceding business day.

"Contracts for the delivery of petroleum or its products may be assigned, and the assignee shall succeed to all the rights of the assignor.

"All assignees of such contracts shall be bound by the obligations of the original contracts.

"In case any party holding a contract for petroleum or its products shall become insolvent, then all such contracts held by such party shall become due immediately, and shall be settled by the parties in interest at the market price of the day when such insolvency occurs, for the deliveries stipulated in the contracts, less the customary brokerage. All assignments of contracts made in contemplation of, or after, insolvency, shall be void.

"Nothing contained in these rules shall be constrained to prevent either of the original contracting parties from making delivery to or claiming delivery from the other party to the contract, but such delivery shall in no way otherwise invalidate the rights of any assignee of such contract. In case, however, a contract has been assigned and either of the original contracting parties shall become insolvent, the other party to the contract may, at any time before the maturity of the contract, demand a sufficient margin from the assignee to make the contract good at the market price of the day for the delivery stipulated in the contract, and the party calling the margin shall put up an equal amount. Both margins shall be deposited in such trust company as shall be agreed upon, and such margins shall be kept good. If the demand for margin under this rule be not complied with within twenty-four hours after said demand, it shall then or thereafter be at the option of the aforesaid party to the contract to cancel the same, and settlement shall be made at the market price of the day next following such demand, for the delivery stipulated in the contract, less the customary brokerage.

"Inspection.

"Buyers shall have the right of naming their inspector, but shall do so at least five days before the maturity of the contract, failing in which the sellers may employ, at buyer's expense, any regular petroleum inspector approved by the Committee on Petroleum, and his certificate that the oil is in conformity with the contract shall be accepted. On a contract for prompt delivery, or where no notice is required, buyers shall name their inspector when contract is executed, otherwise sellers may appoint the inspector at buyer's expense.

"It shall be the duty of the inspector to promptly inspect all goods tendered, and in case of rejection, to notify the seller immediately, to the end that he may be able to fill his contract by replacing the rejected goods.

"In case of dispute between buyer's inspector and the seller, in consequence of the rejection of goods, the seller shall have the right to name an inspector, and if the two cannot agree they shall name a third inspector as umpire, and a majority of the three shall decide the case, and render it incumbent upon the umpire to give a certificate in the regular form, without reference to the dispute. Inspectors to whom such dispute is referred shall have held uninterrupted license from the New York Produce Exchange for at least two years.

"Inspectors shall have the right to require barrels to be filled with refined petroleum at least twelve hours before the goods are tendered for inspection.

"GENERAL RULES.

The forms of contract hereto annexed are hereby made part of these rules, and when not otherwise stipulated, it will be understood that negotiations are based upon them.

"Washed or fictitious, sales are positively forbidden.

"Any disputes arising on contracts for petroleum and its products to be delivered in Philadelphia or Baltimore shall be adjusted by these rules.

"All transactions in petroleum and its products among members of the New York Produce Exchange shall be governed by the above rules, but nothing therein contained shall be construed as interfering in any way with the rights of members to make such special contracts or conditions as they may desire."

We give below the form of contract for sales of refined oil in bulk and in barrels, as showing the general form of all these contracts:

CONTRACT FOR REFINED OIL IN BULK.

NEW YORK, ... 18

Sold for account of M . . . . . .

To M . . . . . .

. . . . . gallons of refined petroleum in bulk, color, to be standard white, or better; burning-test 110 degrees Fahrenheit, or upward, at . . . . . cents per gallon, cash on delivery. To be delivered in yard at . . . . . option as to time of delivery during the . . . . . .

. . . . . .

Subject to the rules of the New York Produce Exchange.

Brokerage ½ of one per cent. by seller.

. . . . . .

Broker.

OPTION CONTRACT FOR REFINED OIL IN BARRELS.

NEW YORK, ... 18

Sold for account of M . . . . . .

To M . . . . . .

. . . . . barrels . . . . . per cent., more or less, refined petroleum. Color to be standard white, or better. Burning-test 110 degrees Fahrenheit, or upward, at . . . . . cents per gallon, cash on delivery, in yard suitable to vessel. Vessel to be ready not earlier the . . . . . of . . . . . 18 . . , nor later than the . . . . . of . . . . . 18, . . , with . . . . . days to load.

. . . . . .

Subject to the rules of the New York Produce Exchange.

Brokerage ½ of one per cent. by seller.

. . . . . .

Broker.

It may be well to add that the 44° gravity, Baumé, United States Dispensatory standard, mentioned in these rules, corresponds to .8045 real specific gravity. Reference is also made to Standard White color. There are three grades of color recognized in export shipments—Standard White (straw color), Water White (colorless), and a shade of color intermediate between the two, called Prime White. One of the rules speaks of 110° fire test. This means an oil which does not ignite when raised to this temperature in a testing apparatus, which we will describe later, and a spark of fire, by means either of a burning splinter of wood, a burning piece of string, a little lamp or gas jet, or electricity, is applied to it. When no other test is designated in a contract 110° test is implied. But many countries have their own laws to regulate the test of the oil that can be legally used, and these laws generally prescribe the means for ascertaining the test. For example, England has fixed a minimum limit in the flash at 73° Fahrenheit, on an instrument devised by the eminent chemist, Sir Frederick Abel, with the aid of Dr. W. Kellner, assistant chemist of the English War Department. The test is to be found in the manner carefully outlined by the law, to be explained more fully in our section on modes of testing. Germany has a different test, with a minimum of flash at 21° on the Celsius scale or centigrade division of the thermometer, corresponding practically to 70° Fahrenheit, their own instrument to be used. In preparing oil for shipment to any country an effort is always made to have it comply with the legal requirements in regard to test, the oil being examined according to the mode of testing prescribed by that country.

State Laws Regulating the Sale of Petroleum Products.—The legislatures of nearly all the states of the Union have enacted some restrictions on the manufacture and sale of oils. These show a wide divergence as regards the mode of examination and the test prescribed. It is not our intention to review this confused condition of legislation. The law in our state is that of May 15, 1874 (P. L. 189). It is, perhaps, as simple and satisfactory as any. It fixes a fire test limit of not less than 110° Fahrenheit for any illuminating product, such fire test to be ascertained on the Tagliabue cup, or the instrument that may be used by the inspectors of export oil. We append a copy of the law:—

PENNSYLVANIA STATE LAWS FOR PETROLEUM

(P. L. 189, May 15, 1874).

1. No refined petroleum, kerosene, naphtha, benzole, gasolene or any fluid, be they designated by whatsoever name, the fire-test of which shall be less than 110 degrees Fahrenheit, shall be sold or offered for sale as an illuminator for consumption, within the limits of the Commonwealth of Pennsylvania.

2. Said fire-test shall be determined by an inspector appointed under the provisions of this act, who shall use Tagliabue's or such other well-defined instrument as may be used by the inspectors of export oil, according to the following formula: Heat with alcohol small flame; when thermometer indicates ninety degrees remove lamp; at ninety-five try for a flash, with small bead of fire on end of string, held within a quarter of an inch of surface of oil; replace lamp, and work oil up gradually from this point until the burning point is reached, removing lamp every four degrees, and allowing oil to run up three degrees before replacing lamp, flashing oil each time, just before lamp is replaced, until result is attained.

3. The said inspector shall be appointed by the courts of common pleas, one in each county in the commonwealth, wherein said burning oil or fluids as before mentioned, are manufactured: *Provided*, That in any county where there shall be more than one court of common pleas, the said appointments shall be made by court No. 1, in said counties, and in any county wherein is situated a city of more than three hundred thousand inhabitants, in such case in lieu of court No. 1, the appointment of inspector shall be made by the mayor of said city.

4. The said inspectors shall hold their office for the term of three years, unless sooner removed by the appointing power, for incompetency, or found guilty under the provisions of this act; vacancies in said office to be filled by the authority in which the appointing power is vested by this section. The said inspectors shall be authorized to appoint such clerks or deputies as they may find requisite for the carrying out of the duties specified under this act; the said clerks and deputies shall be paid out of the fees of the office, by the inspector of the county wherein the service is performed; all clerks and deputies are held answerable by this act, and subject to the same penalties for violating any of its provisions as are provided in this act for the punishment of the appointed inspectors. Each inspector, deputy or clerk, after receiving his appointment, and prior to entering upon the duties of the office for which he is appointed, shall file in the office of the prothonotary of the court of common pleas, an oath or affirmation that he will well and truly perform the duties of his office and carry out the provisions of this act, and said inspectors shall also file a bond, with one or more approved securities, in style similar to that of the sheriff of the county, in the penal sum of ten thousand dollars, for the faithful performance of the duties of said inspector's office, as provided in this act. The said inspector is hereby empowered to receive and collect from the manufacturer or owner the sum of 20 cents per package for each package inspected in any lot under ten; ten cents per package for each package inspected, in any lot not more than fifty; seven cents per package for each package inspected, in

any lot or all lots over fifty; and one dollar for each car of bulk refined oil; and in case any person shall call upon said inspector to inspect one package of refined oil, he shall charge said person for each inspection fifty cents. The said inspector shall provide at his own cost, stencils for the purpose of branding packages, to read thus: "State of Pennsylvania, fire-test one hundred and ten degrees," with name of inspector: *Provided*, When oil so inspected shall stand higher test, the inspector shall designate such actual test by his brand.

5. The said inspector, or his clerks or deputies, shall and are hereby empowered to enter any place or building where oil or fluids, as before designated in this act, are manufactured, kept in store for sale or consumption, in this commonwealth, and in such counties where oil is sold and not manufactured, for which no inspector has been appointed, or in any other place within the limits of this state, wherein he has reason for believing that oil is being kept or sold contrary to the provisions of this act, or for the purpose of carrying out the true intent and meaning of this act, any inspector shall have the privilege to re-inspect, and is hereby empowered to inspect any oil, as hereinbefore designated in section first, which he may, by any reason believe to be under fire test, and if so found by him to be under fire test and falsely branded, he shall prosecute or cause to be prosecuted the offender, as herein authorized in section four of this act; no charge shall be made for re-inspection.

6. Any person violating any of the provisions of this act shall, upon conviction thereof, be deemed guilty of a misdemeanor, and shall be subject to a fine of not less than two hundred and fifty ($250) dollars, nor more than five hundred ($500) dollars or imprisonment not less than one year, or both, at the discretion of the court, one half of said fine to go to the prosecutor and one half to the school fund in the district where such misdemeanor may have been committed. Also, if any person shall sustain damage to his property or injury to his person, by reason of a violation of any of the provisions of this act by another person, the person guilty of said violation shall be liable to the person injured for all damages sustained thereby.

7. All the oils or fluids subject to inspection under this act that may be found in the hands of those who sell in less quantities than one barrel, with a fraudulent brand or mark of inspection, or found to have been adulterated or not coming up to the fire test, as the mark of inspection would indicate, shall be subject to seizure by the said inspector, and the same shall, after ten days, public notice, be sold solely for redistillation, the proceeds of such sale, after deducting the necessary expenses of sale and seizure, shall one-half be given to the public school fund wherever the seizure was made, and one-half to the informer.

8. Any inspector or deputy appointed under this act, who shall violate any of its provisions, by neglecting to inspect upon request, or shall falsely brand any oil or fluid, shall be deemed guilty of a misdemeanor, and upon conviction thereof, shall be fined not less than two hundred and fifty ($250) dollars, nor more than one thousand ($1,000) dollars, and be subject to imprisonment for not less than three months or more than one year, or both, subject to the discretion of the court, one-half of the fine to go to the informer, and one-half to the school fund of the district wherein the offense was committed.

9. The packages containing oil manufactured for export shall be branded with a stencil by the manufacturer with the words "for export," all benzine, naphtha or any hydro-carbons, created in the manufacture

of refined oil from crude petroleum, or otherwise manufactured, shall be inspected and branded "Benzine" and shall not be kept for sale or used in any way for giving light to be burned in lamps, and this act shall not be construed to prohibit their use in making gas to be conveyed through pipes to burners similar to gas in city gas works, to be used for the same purpose, and further the penalties for violating this section shall be the same as applied to the use of refined oil below legal test.

10. Nothing contained in this act shall be construed or held to apply in any manner, to any kind of oil or fluid manufactured for export from this state, or in transit from one state to another through the limits of this commonwealth.

11. Any person or persons who shall sell or cause to be sold any barrel or package, or who shall refill the same without first removing the brand of the inspector, shall be liable to a fine of three hundred dollars for every barrel or package sold or delivered or refilled, said fines shall be recoverable as other fines of like character are recoverable by law, and one-half shall go to the informer, and one-half to the school fund of the district in which the offense was committed.

MODES OF TESTING PETROLEUM PRODUCTS.

Refined Oil.—Lubricating Oils.—Paraffine Wax.

Refined Oils.—In addition to an inspection for color, which is a simple examination by the eye, refined oils are subjected to two tests, one to ascertain their specific gravity, and the other to determine their fire test. The lines of demarkation between oil and naphtha, the product from crude lighter than oil, on the one hand, and between oil and residuum, the product heavier than oil, on the other, is, as has been seen, a purely arbitrary one. It has also been seen that it is not practicable to make an oil absolutely free from the volatile elements of the crude called naphtha, or the heavier elements that should be left in the still as residuum. The presence of too large a proportion of the former renders the oil unsafe for illuminating purposes, as these lighter hydro-carbons vaporize at temperatures so low that the lamp may become filled with gas and an explosion follow. The presence of too large a proportion of the heavier elements injures the illuminating properties of the oil by preventing it from burning freely. The specific gravity test aims to show the density of the oil, and so to indicate, in a general way, the quantity of the heavier hydro-carbons it contains.

Gravity.—To make a test for gravity, a tall glass jar is filled with the oil and a combined hydrometer and thermometer is immersed in it. The hydrometer, which is graded according to the Baumé scale, registers the gravity, and the thermometer indicates the temperature of the oil. Standards for gravity require the oil to be at 60° temperature when tested, but carefully prepared tables have been made for correcting the hydrometer reading to a 60° temperature basis, so that the gravity can be ascertained quickly with the oil at temperatures both above and below 60°. We give, among our statistics on petroleum products, a table showing the corresponding real specific gravity and the weight of one gallon of oil for each degree of the Beaumé hydrometer. In the absence of a table, however, Baumé can be easily converted into real specific gravity, by dividing 140 by 130, plus the degree indicated on the Baumé scale.

Flash and Fire Tests.—The test for gravity is of but little moment in comparison with that to ascertain the fire test of the oil. Upon it the public have to depend for a guarantee that the product can be used for illuminating purposes with safety. Proper methods and sufficient care should be employed in manufacture to insure, in the finished product, the absence of the more volatile hydro-carbons, which are vaporized at low temperatures, and may form an inflammable atmosphere in the oil reservoir of lamps. According to the axiom of Dr. F. H. Chandler,

of the Columbia College School of Mines, "No lamp is safe with dangerous oil and every lamp is safe with safe oil." This does not necessarily mean the establishment of a high test requirement that will be burdensome, both to the manufacturers by restricting their yield to too narrow limits, and, at the same time, to the consumers, it being a well known fact that, as the test is raised, oil proves less satisfactory as an illuminant, specially constructed lamps being required to make very high products burn at all. There is needed, simply, a test that will detect the presence of the easily volatilized elements, which unscrupulous refiners sometimes leave in their burning oil to cover up defects in manufacture. As low a fire test requirement as comes within the limit of safety, rigorously enforced, is all that is needed to accomplish this end.

While considering this topic of safety we cannot forbear to quote a paragraph from an article by Mr. Boverton Redwood, the secretary of the London Petroleum Association, and their inspector, who was the associate of Sir Frederick Abel in the most thorough investigation of the subject made in England before the adoption of the admirable law now in force. That the same conclusion has been reached by every scientific study of the question, is reassuring to the people of Pennsylvania to whom the petroleum industry is so important:—

"There are probably no grounds for supposing that petroleum oil constitutes a dangerous article in the ordinary stock of an oilman. On the contrary, there is a good deal of evidence in support of the opposite view. Thus, to take one instance only, in the case of one of the most recent fires at an oilman's shop almost the only portion of the contents of the shop which had escaped destruction were three barrels of petroleum oil, constituting, according to the evidence given, the whole stock of this material on the premises at the time of the fire. These barrels were a good deal charred, but still held a considerable quantity of oil. Petroleum is, in fact, a far less dangerous liquid than is commonly supposed, as was pointed out some years ago, and again last year, by Sir Frederick Abel in lectures at the Royal Institution. Statistics show that the destruction of petroleum-laden ships by fire is very rare, and at least one case is on record where a vessel carrying petroleum having been set on fire by lightning, the fire was extinguished, and the cargo brought safely into port. Many barrels discharged from the vessel in question bore evidence of the heat to which they had been subjected, being in some cases so much charred that a penknife blade could be driven through the staves, and yet these barrels still held the oil intact."

When oil is heated, vapors are thrown off, and, being heavier than air, they do not rise far from the surface of the oil under test. On passing a light over this surface, as the temperature of the oil is raised; there will first appear what the English Petroleum Act of 1862 describes as a "pale blue flicker or flash," caused by the vapor igniting and burning off from the surface of the oil. The temperature of the oil when this first occurs, is called its "flash test" or "flashing point." As the

temperature rises still further, a point is reached at which the oil itself takes fire on the application of a lighted taper. This is called its "burning point" or "fire test." Ignition is always preceded by a flash, but the difference in temperature between the points of flash and burning varies according to the grade of oil and its mode of manufacture. It will be clear from this description that at neither of these temperatures would the oil ignite in spontaneous combustion, as a light is required to secure even the flash referred to. Spontaneous combustion will not take place until the oil has been heated to at least 300 degrees higher than the technical "burning point" prescribed by our state law. Testers soon found that the flash and burning points were affected by the manner in which the oil was heated, by the size of the light applied to the surface, and by many other features of the test, if the details were left to the discretion of the operator. It was necessary either to outline with great minuteness every step in the test, or invent an instrument that would do the work mechanically, and, therefore, always uniformly. Modern testing cups aim to do this. The instruments have been improved, and modes of testing made more uniform. The old method of passing a burning splinter of wood or a bead of fire on the end of a string across the surface of the oil, has been supplanted by mechanical devices which carry the flame of a little lamp near to the oil, or by the use of an electric spark.

The apparatus adopted by the New York Produce Exchange is that known as the Saybolt Electric Tester, which has been in use since 1879 It is much like the Tagliabue cup; but uses an electric spark instead of a burning splinter of wood to communicate the fire to the vapor. A copper water bath, heated by a spirit lamp or gas jet, has set in its top a glass petroleum holder. A thermometer is held in place in the water bath, and another in the oil, while a clever device throws an electric spark across the surface of the oil whenever desired. The water bath is filled and heated to 100° degrees Fahrenheit, and the lamp removed. The oil cup is filled to within one-eighth of an inch of its top, and placed in the bath. When the temperature of the oil reaches 90,° an electric spark is sent across it. The lamp is then replaced under the water bath and the spark applied when the temperature of the oil is 95°, and again when it is 100°, 104°, 108°, 110°, 112°, and 115°, or until the oil flashes. The cup prescribed by our state law is the Tagliabue open cup, which is about the same as the Saybolt cup, except that a lighted taper, instead of an electric spark, is used—the objective point being that at which the oil itself ignites.

Undoubtedly the test most widely employed the world over is that of Sir Frederick Abel adopted by the English Parliament, August 11, 1879. The specifications of the apparatus as described minutely in the law are briefly as follows:

A cylindrical oil cup of gun metal or brass, tinned inside, 2 inches in diameter and 2.2 inches high, provided with a close-fitting, overlapping brass cover which carries the thermometer and test lamp, is suspended in a bath or heating vessel consisting of two flat-bottom copper cylinders—the inner one 3 inches in diameter and $2\frac{1}{2}$ inches high, the outer one $5\frac{1}{2}$ inches in diameter and $5\frac{3}{4}$ inches high—the smaller set inside of the larger, and the space between them filled with water. The oil cup, therefore, is surrounded by an air space of one-half inch, heated by a water bath; which, in turn, surrounds it. A copper cylinder or jacket, $6\frac{1}{2}$ inches in diameter, surrounds the water bath. A thermometer is provided for the water bath and another for the oil. The light for testing is furnished by a little lamp, supported on the cover of the oil cup in such a way that, as a slide is moved—uncovering a square hole in the cover of the cup—it is tilted so as to bring the flame just below the cover, returning to its original position as the slide is moved back. Near the lamp is a little bead, the dimensions of which repre sent the size of the test flame to be used. Where gas is to be obtained the oil lamp is to be replaced by a gas flame; but the size of the flame, is still to be regulated by the standard bead. The temperature of the water bath is brought to 130° and the lamp used for heating is withdrawn. The oil cup is then filled to within one-half inch of the top with oil at 60° temperature, and placed in position. When the oil reaches 66° the operation of testing is commenced; the test flame being applied once for every rise of one degree. This is done by slowly drawing open the slide—while a pendulum, 24 inches in length, performs three oscillations—and closing during a fourth oscillation; the movement of the slide swinging the light of the testing lamp below the cover of the oil cup, as described above.

LUBRICATING OILS.—In addition to tests for gravity, flash and burning points—which are made in ways somewhat similar to the tests applied to the refined oil—lubricating oils are subjected to two other tests; to determine their "viscosity," and their "cold test." By the former it is claimed that the lubricating properties of the oil can be, to a large extent, determined. It shows its viscidity or glutinous quality. The test is made by noting the length of time occupied by a given quantity of the oil in flowing through a small orifice, of prescribed dimensions and form, at a given temperature; the longer the time required the greater the viscosity.

By cold test is meant the temperature at which the oil thickens or becomes cloudy or ceases to flow because of the crystallization of the paraffine it contains. The test is usually made by slowly cooling the oil in a small tube or long bottle about $5\frac{1}{2}$ inches in length and $1\frac{1}{2}$ inches in diameter, in which a thermometer is inserted to note the temperature at which the oil no longer flows when the bottle or tube is inclined, or the temperature at which deposition of paraffine commences.

Paraffine Wax.—This is subjected to two tests, one to ascertain the amount of oil left in it, and the other to determine its melting point. The former test is applied by noting the loss in weight of a given quantity of wax when subjected to a specified pressure for a certain length of time. By melting point is meant the temperature at which the wax after being melted begins to solidify on cooling. A thermometer is inserted in the melted wax and used to gently agitate it until a film of the crystallizing product appears. The temperature as noted is the so-called melting point of the wax.

10B.-10-92.

INVESTMENT OF CAPITAL AND EMPLOYMENT OF LABOR IN PETROLEUM MANUFACTURE.

Comparison of Records of Tenth and Eleventh United States Census.—Number of Employes during 1889.—Wages Paid in 1889.—Tables of Statistics.

We have brought together in the tables that follow the records of the Tenth and Eleventh United States Census in regard to petroleum manufacture. We have already, under the head of petroleum production, compared these records so far as they cover the mining and storing of crude oil. We will here simply repeat that the total number of men employed in producing crude during the census year ending May 31, 1880, was 11,157, and the wages paid were $6,987,900. The men employed during the census year ending December 31, 1889, were 19,832, and the wages paid, $7,423,781.

The census figures on manufactures bear out the other records submitted in this report of the growth of the petroleum industry. During the year of the Tenth Census, 17,417,455 barrels (42 gallons) of crude oil were consumed. During the year of the Eleventh Census, the consumption had increased to 29,474,774 barrels (42 gallons), a gain of 70 per cent. This increase represents 506,407,384 gallons for the year, or over 40,000 barrels for each working day of the year. The magnitude of this increase can perhaps be most easily comprehended when we recollect that, up to the year 1877 (only three years before the Tenth Census), the total yearly production of crude had been much less than this gain in annual consumption during ten years. The average production of crude for 1875 and 1876 was only three-fourths of this increase in consumption and less than one-third, in fact only 30 per cent. of the total consumption for the year 1889.

The investment of capital in the industry corresponded with the growth. During the decade, the total money employed in manufacturing petroleum was almost trebled, being increased from $27,325,746 to $76,383,608. Unfortunately the census of 1880 did not work out the divisions of investment to the extent that the census of 1889 will do; but the items which we have of cost of buildings and of cost of machinery and tools seem to ratify the accuracy of the increase in total investment, the former showing over three times, and the latter over five times, as much in the latter as in the earlier period.

The records of the Eleventh Census on the employment of labor and wages, while not absolutely complete, are very comprehensive and, we believe, unusually accurate. The census of ten years before presented only the total number of employes engaged in manufacturing petroleum products and made no report whatever of the men employed in produc-

ing crude oil. In both these departments the Eleventh Census furnishes exhaustive records, giving the number of men carefully classified as to the branches of work done and the rates of wages received. Our tables "BB," "CC," and "EE," prepared from data of the Eleventh Census show these facts fully in reference to the production of crude. We append two tables (KK and LL) giving the record of labor employed and wages received in manufacturing the countless products of petroleum. The numbers employed in each class of work were as follows:

Superintendents,	28	Carpenters,	227
Foremen,	195	Machinists,	140
Salesmen,	23	Compounders,	4
Bookkeepers,	9	Boxmakers,	79
Clerks,	436	Filter-housemen,	17
Boys, office, etc.,	555	Barrel-housemen,	35
Stillmen,	481	Pumpmen,	69
Chief stillmen,	12	Fillers,	16
Still cleaners,	102	Inspectors,	21
Treaters,	132	Packers and shippers,	52
Coopers,	1,907	Tinsmiths,	422
Pipe-fitters,	200	Painters and gluers,	18
Laborers,	3,703	Lightermen,	25
Engineers,	114	Blacksmiths,	36
Firemen,	440	Masons,	39
Yardmen,	44	Solderers,	38
Mechanics,	271	Cap solderers,	35
Pressmen,	246	Bricklayers,	11
Boiler-makers,	302	Car builders,	75
Boilermen,	115	Faucet makers,	28
Bone burners,	15	Lead burners,	3
Teamsters,	165	Candle makers,	9
Watchmen,	126	Various helpers,	160

This shows a total of 11,180 men. To these must be added 1,356 men noted on reports not made in sufficient detail to admit of classification. This makes the total employes in manufacturing . . . 12,536
The record of men engaged in production shows 19,832

Total 32,368

Large as this number is, it does not enumerate all the labor force of the industry. A moment's reflection will suggest that it does not include men occupied in transporting the crude oil by pipe or cars, nor in moving the various products by rail, barge, sailing vessel and steamer. Nor does it embrace the large corps engaged in the many mercantile branches of the business. It would probably not be an overstatement to estimate the total employes in the petroleum industry at 50,000.

The rates of wages paid, we are inclined to think, will compare favorably with those given in any other industry of equal magnitude. Of the total 11,180 employes in manufacturing petroleum products, only 1,310, or less than 12 per cent., received below $1.50 per day, while 4,528, or

over 40 per cent., were paid at the rate of $2.00 per day and above. Of the 12 per cent. receiving less than $1.50 per day, fully 5 per cent. were office boys. Returns similar to those furnished the Census Bureau, but of to-day's date, would show a considerable increase in the number of employes, and if any change in wages, they would be advances.

The following tables support the statements just made:

TABLE HH. *Quantities and values of crude petroleum consumed, and of petroleum products manufactured for the years covered by the reports of the Tenth United States Census (year ending May 31, 1880), and the Eleventh United States Census (year ending December 31, 1889)..*

TABLE II. *Capital employed in the manufacture of petroleum products as shown by the Tenth and Eleventh United States Census reports.*

TABLE JJ. *Comparisons of capital invested, cost of materials, and value of products in manufacturing petroleum during the years covered by the reports of the Tenth and Eleventh United States Census.*

TABLE KK. *Classes of labor employed and wages paid in manufacturing petroleum products during the year ending December 31, 1889.*

TABLE LL. *Range of wages paid in manufacturing petroleum products during the year ending December 31, 1889.*

[Table HH.]

Quantities and Values of Crude Petroleum Consumed and of Petroleum Products Manufactured, for the Years Covered by the Reports of the Tenth United States Census (Year Ending May 31, 1880), and the Eleventh United States Census (Year Ending December 31, 1889).

	Tenth United States Census.		Eleventh United States Census.		Increase of Eleventh over Tenth Census.	
	Barrels.	Value.	Barrels.	Value.	Barrels.	Value.
Crude petroleum consumed.	17,417,455	$16.340.581	29,474,774	$44.267.554	12.057.319	$27.926,973
Products:—						
Naphtha and Gasoline.	1,508,049	$2,990,678	3,576,934	$7,759,637	2.068,885	$4.768.959
Illuminating oils,	11.018,793	37.042,338	17,863,861	51,031,914	6.845,068	13.989,576
Residuum,	229,133	297,529	718.106	879,052	488,973	581.523
Paraffine oils,	79,465	408.023	595,327	2,493.463	515.862	2,085,440
Reduced oils.	204,841	1,024,017	733.855	1.863,876	529.014	839.859
Neutral filtered oils.	70,415	611,572	110,165	410,729	39,750	*200.843
Filtered cylinder oils.	26,018	371,020	242,992	1.299.798	216.974	928.778
Ointments and greases.	.....	134,513	49,155	804.306	49.155	669,793
Paraffine wax,	31,558	631,944	183,260	2,412,396	151.702	1,780,452
Residuum products,	.....	.....	.....	63.908	.....	63.908
All other products,	.....	193,584	.....	5.349,372	.....	5,155,788
Total manufactured products,	13,168,272	$43.705.218	24,073.655	$74.368.451	10.905.383	$30,663,233

Crude petroleum figured at 42 gallons to the barrel; petroleum products figured at 50 gallons to the barrel: paraffine wax figured at 250 pounds to the barrel. Value of products does not include packages. Values are in dollars.

* Decrease.

[TABLE II.]

CAPITAL EMPLOYED IN THE MANUFACTURE OF PETROLEUM PRODUCTS, AS SHOWN BY THE TENTH AND ELEVENTH UNITED STATES CENSUS REPORTS.

	Tenth United States Census.	Eleventh United States Census.
Investment in land	No record.	$7,524,626
Investment in buildings	$1,899,288	6,173,259
Investment in machinery, tools, etc.	3,737,998	19,338,480
Total investment in plant	No record.	$33,036,365
Capital, other than that invested in plant	No record.	$43,347,243
Total capital invested	$27,325,746	$76,383,608
Number of firms and corporations	86	105

The Tenth United States Census Report was for the year ending May 31, 1880.

The Eleventh United States Census Report was for the year ending December 31, 1889.

[TABLE JJ.]

COMPARISONS OF CAPITAL INVESTED, COST OF MATERIAL AND VALUE OF PRODUCTS IN MANUFACTURING PETROLEUM DURING THE YEARS COVERED BY THE REPORTS OF THE TENTH UNITED STATES CENSUS (YEAR ENDING MAY 31, 1880), AND THE ELEVENTH UNITED STATES CENSUS (YEAR ENDING DECEMBER 31, 1889).

	Tenth United States Census.	Eleventh United States Census.	Increase of the Eleventh over Tenth Census.	
			Amounts.	Percentages.
Number of firms or corporations	86	105	19	
Total capital invested	$27,325,746	$76,383,608	$49,057,862	179
Cost of materials:				
Crude oil	$16,340,581	$44,267,554	$27,926,973	170
Fuel	1,319,008	1,748,600	429,592	
Sulphuric acid	1,206,052	1,488,363	282,311	
Packages	15,964,627	16,466,932	502,305	
All other material	168,833	12,969,640	12,800,807	
Total cost of raw material	$34,999,101	$76,941,089	$41,941,988	120
Total value of manufactured product, including packages	$59,669,845	$90,835,384	$31,165,539	52

[TABLE KK.]

CLASSES OF LABOR EMPLOYED AND WAGES PAID IN MANUFACTURING PETROLEUM PRODUCTS DURING THE YEAR ENDING DECEMBER 31, 1889.

(From data Eleventh United States Census.)

SUPERINTENDENTS.			FOREMEN.				SALESMEN.			BOOKKEEPERS.			CLERKS.					
No.	Rate per month.	Rate per day	No.	Rate per day.	No.	Rate per month.	Rate per day.	No.	Rate per month.	Rate per day.	No.	Rate per month.	Rate per day.	No.	Rate per day.	No.	Rate per month.	Rate per day.	No.	Rate per month.
6	. . . . .	$8 91	13	$5 41	28	. . . . .	$2 50	1	. . . . .	$4 00	2	. . . . .	$4 00	1	$5 00	8	. . . .	$2 00	3	$75
2	. . . .	8 33	2	5 00	1	. . . . .	2 10	3	. . . . .	3 25	1	. . . . .	3 50	18	4 00	1	. . . .	1 90	1	70
3	. . . . .	8 00	1	4 00	1	. . . . .	2 00	3	. . . . .	1 66	1	. . . . .	3 25	1	3 84	1	. . . .	1 75	2	62½
2	. . . . .	7 83	7	3 75	1	. . . . .	1 85	12	$125	. . . . .	3	$108⅓	. . . . .	3	3 40	1	. . . .	1 70	1	60
1	. . . . .	7 00	5	3 72	6	. . . . .	1 62	1	100	. . . . .	1	100	. . . . .	1	3 33	5	. . . .	1 65	5	50
2	. . . . .	6 00	2	3 50	1	. . . . .	1 60	3	83⅓	. . . . .	1	60	. . . .	211	3 30	1	. . . .	1 60	2	45
1	. . . . .	5 48	43	3 35	1	$100	. . . . .	. . . .	. . . . .	. . . . .	. . . .	. . . . .	. . . . .	1	3 25	1	. . . .	1 50	1	40
2	. . . . .	5 00	8	3 33	3	83⅓	. . . . .	. . . .	. . . . .	. . . . .	. . . .	. . . . .	. . . . .	1	3 20	1	. . . .	1 20	3	35
1	. . . . .	3 40	2	3 15	1	60	. . . . .	. . . .	. . . . .	. . . . .	. . . .	. . . . .	. . . . .	78	3 00	3	$150	. . . .	. . .	. . . .
1	. . . . .	3 00	9	3 03	. . . .	. . . . .	. . . .	. . . .	. . . . .	. . . . .	. . . .	. . . . .	. . . . .	4	2 92	2	125	. . . .	. . .	. . . .
1	$250	. . . . .	22	3 00	. . . .	. . . . .	. . . . .	. . . .	. . . . .	. . . . .	. . . .	. . . . .	. . . . .	17	2 86	1	117	. . . .	. . .	. . . .
1	240	. . . . .	29	2 95	. . . .	. . . . .	. . . . .	. . . .	. . . . .	. . . . .	. . . .	. . . . .	. . . . .	4	2 70	4	110	. . . .	. . .	. . . .
1	208⅓	. . . . .	2	2 92	. . . .	. . . . .	. . . . .	. . . .	. . . . .	. . . . .	. . . .	. . . . .	. . . . .	9	2 60	4	104⅙	. . . .	. . .	. . . .
1	166⅔	. . . . .	1	2 75	. . . .	. . . . .	. . . . .	. . . .	. . . . .	. . . . .	. . . .	. . . . .	. . . . .	12	2 50	4	100	. . . .	. . .	. . . .
3	66⅔	. . . . .	4	2 66	. . . .	. . . . .	. . . . .	. . . .	. . . . .	. . . . .	. . . .	. . . . .	. . . . .	1	2 25	9	83⅓	. . . .	. . .	. . . .
			2	2 55	. . . .	. . . . .	. . . . .	. . . .	. . . . .	. . . . .	. . . .	. . . . .	. . . . .	8	2 12	2	80	. . . .	. . .	. . . .
Total, 28			Total, 195.					Total, 23.			Total, 9.			Total, 436.					

[TABLE KK —*Continued.*]

BOYS, OFFICE ETC.			STILLMEN.					CHIEF STILLMEN.		STILL CLEANERS.		TREATERS.					COOPERS				
No.	Rate per week.	Rate per day.	No.	Rate per day.	No.	Rate per month.	Rate per day.	No.	Rate per day.	No.	Rate per day.	No.	Rate per day.	No.	Rate per month.	Rate per day.	No.	Rate per day by piece.	Rate per day.	No.	Rate per day.
50	....	$1 33	3	$3 75	24	....	$2 00	2	$4 50	23	$2 50	1	$4 16	3	....	$1 75	28	$3 00	....	39	$2 13
2	....	1 25	6	3 37	26	....	1 92	3	4 33	49	2 00	2	4 00	1	....	1 50	11	2 55	....	89	2 00
31	....	1 07	4	3 30	2	....	1 90	7	4 00	3	1 70	3	3 50	2	$100	....	599	2 30	....	194	1 95
4	....	1 00	14	3 00	31	....	1 75	.....	.....	27	1 50	2	3 37	1	90	....	151	1 50	$1 90	5	1 87
1	....	96	42	2 86	8	....	1 62	.....	.....	.....	.....	2	3 33	1	75	....	87	1 14	....	214	1 78
210	....	90	4	2 85	2	....	1 60	.....	.....	.....	.....	5	3 30	1	60	....	6	85	....	30	1 75
82	....	83	7	2 75	1	....	1 57	.....	.....	.....	.....	5	3 25	2	50	....	20	piece.	....	2	1 67
29	....	80	1	2 67	1	....	1 50	.....	.....	.....	.....	1	3 20	...	....	....	32	....	2 75	4	1 65
24	....	79	4	2 57	2	....	1 25	.....	.....	.. ..	.....	8	3 00	...	....	....	17	....	2 70	1	1 60
57	....	75	62	2 50	2	....	1 20	.....	.....	.....	.....	8	2 86	...	....	....	1	....	2 66	1	1 57
2	....	67	2	2 40	2	$80	....	.....	.....	.....	.....	6	2 75	...	....	....	5	....	2 62	44	1 50
15	....	62	8	2 37	2	75	....	.....	.....	.....	.....	1	2 57	...	....	....	231	....	2 50	2	1 33
32	....	60	31	2 30	1	60	....	.....	.....	.....	.....	22	2 56	...	....	....	50	....	2 30	4	1 25
10	....	58	55	2 28	...	....	....	.....	.....	.....	.....	28	2 50	...	....	....	9	....	2 28	...	.....
5	....	55	113	2 25	...	....	....	.....	.....	.....	.....	9	2 25	...	....	....	14	....	2 25	...	.....
1	$1 00	....	21	2 17	...	....	....	.....	.....	.....	.....	7	2 20	...	....	....	11	....	2 22	...	.....
												10	2 00	...	....	....	4	....	2 20	...	.....
												1	1 80	...	....	....	2	....	2 15	...	.....
Total, 555.			Total, 481.					Total, 12.		Total, 102.		Total, 132.					Total, 1,907.				

[TABLE KK—*Continued.*]

PIPE-FITTERS.		LABORERS.			ENGINEERS.			FIREMEN.			YARDMEN.		MECHANICS.		PRESSMEN.			BOILER-MAKERS.	
No.	Rate per day.	No.	Rate per month.	Rate per day.	No.	Rate per month.	Rate per day.	No.	Rate per month.	Rate per day.	No.	Rate per day.	No.	Rate per day.	No.	Rate per month.	Rate per day.	No.	Rate per day.
2	$3 00	5	. . . .	$2 50	2	. . . .	$3 66	13	. . . .	$2 50	15	$2 00	1	$4 00	16	. . . .	$2 50	1	$3 83
17	2 50	5	. . . .	2 25	1	. . . .	3 57	67	. . . .	2 25	4	1 75	1	3 33¼	8	. . . .	2 25	1	3 50
3	2 33	161	. . . .	2 00	1	. . . .	3 33	30	. . . .	2 18	1	1 60	2	2 75	2	. . . .	2 00	1	3 00
23	2 26	471	. . . .	1 89	6	. . .	3 25	37	. . . .	2 15	23	1 50	6	2 40	5	. . . .	1 95	.	2 75
34	2 25	77	. . . .	1 75	11	. . . .	3 00	84	. . . .	2 08	1	1 20	2	2 32	42	. . . .	1 81	28	2 65
40	2 00	20	. . . .	1 67	3	. . . .	2 75	39	. . . .	2 00			30	2 25	15	. . . .	1 75	30	2 60
23	1 92	30	. . . .	1 66	4	. . . .	2 68	11	. . . .	1 95			1	2 17	34	. . . .	1 70	7	2 50
2	1 90	35	. . . .	1 65	13	. . . .	2 50	3	. . . .	1 83			6	2 00	19	. . . .	1 69	50	2 27
37	1 80	414	. . . .	1 62	32	. . . .	2 25	87	. . . .	1 80			221	1 83	33	. . . .	1 50	12	2 25
10	1 75	4	. . . .	1 60	4	. . . .	2 12	29	. . . .	1 75			1	1 75	55	. . . .	1 42	50	2 12
9	1 50	135	. . . .	1 57	15	. . . .	2 00	7	. . . .	1 61					16	. . . .	1 25	120	1 82
		1,908	. . . .	1 50	11	. . . .	1 94	1	. . . .	1 60					1	$70	. . . .	1	1 50
		46	. . . .	1 49	3	. . . .	1 90	26	. . . .	1 50									
		160	. . . .	1 40	7	. . . .	1 75	2	. . . .	1 35									
		14	. . . .	1 35	1	$100	. . . .	4	. . . .	1 20									
		119	. . . .	1 25															
		2	. . . .	1 17															
		81	. . . .	1 14															
		7	. . . .	1 00															
		1	$50	. . . .															
		7	45	. . . .															
		1	25	. . . .															
Total, 200.		Total, 3,703.			Total. 114.			Total, 440.			Total. 44.		Total. 271		Total. 246.			Total, 302.	

[TABLE KK—*Continued.*]

BOILERMEN.		BONE-BURNERS.		TEAMSTERS.			WATCHMEN.		CARPENTERS.			MACHINISTS.		COMPOUNDERS.		BOX-MAKERS.		
No.	Rate per day.	No.	Rate per day.	No.	Rate per month.	Rate per day.	No.	Rate per day.	No.	Rate per month.	Rate per day.	No.	Rate per day.	No.	Rate per day.	No.	Rate per day by box.	Rate per day.
2	$3 00	10	$2 50	2	....	$4 50	1	$2 25	3	....	$3 00	4	$3 50	1	$6 00	9	....	$3 33
6	2 50	3	1 75	1	....	4 00	28	2 00	4	....	2 75	1	3 25	1	3 75	43	....	2 50
7	2 25	2	1 60	14	....	2 25	1	2 01	64	....	2 63	3	3 00	2	2 00	10	....	2 35
15	2 12			27	....	2 08	2	1 90	3	....	2 62	8	2 81			6	....	1 50
6	2 09			10	....	2 00	5	1 89	2	....	2 58	2	2 75			3	....	1 16
13	2 02			16	....	1 88	13	1 85	34	....	2 50	19	2 73			5	$3 25	....
39	2 00			33	....	1 80	27	1 80	22	....	2 45	4	2 62			3	by box.	....
21	1 75			23	....	1 76	17	1 75	25	....	2 30	58	2 50					
3	1 71			20	....	1 75	1	1 66	16	....	2 25	26	2 30					
3	1 50			3	....	1 65	3	1 64	2	....	2 17	13	2 25					
				6	....	1 62	16	1 55	25	....	2 12	1	2 00					
				1	....	1 60	7	1 50	24	....	2 00	1	1 75					
				7	....	1 50	3	1 28	2	....	1 75							
				1	....	1 25	1	1 25	1	$60	....							
				1	$55	....	1	1 00										
Total, 115		Total, 15.		Total, 165.			Total, 126.		Total, 227.			Total, 140		Total, 4.		Total, 79		

[TABLE KK—*Concluded.*]

FILTERHOUSE-MEN.		BARRELHOUSE-MEN.		PUMPMEN.		FILLERS.		INSPECTORS		PACKERS AND SHIPPERS		TINSMITHS.			PAINTERS AND GLUERS.		LIGHTERMEN.	
No.	Rate per day.	No.	Rate per day.	No.	Rate per day.	No.	Rate per day.	No.	Rate per day.	No.	Rate per day.	No.	Rate per month.	Rate per day.	No.	Rate per day.	No.	Rate per day.
1	$3 00	1	$2 75	1	$3 33	3	$2 62	2	$4 17	1	$2 50	61	. . .	$2 50	1	$3 50	10	$2 54
6	2 50	3	2 50	1	2 75	2	2 00	1	4 00	16	2 00	10	. . .	2 37	2	2 50	15	2 50
6	2 25	4	2 25	11	2 50	2	1 75	2	3 00	23	1 88	18	. . .	2 30	2	2 00		
4	2 00	2	2 00	2	2 29	2	1 65	1	2 50	12	1 87	23	. . .	2 03	4	1 88		
		2	1 75	3	2 25	3	1 50	5	2 29			3	. . .	2 00	6	1 75		
		1	1 65	4	2 12	4	1 25	4	2 12			32	. . .	1 87	1	1 65		
		9	1 60	7	2 00			3	2 05			150	. . .	1 75	2	1 50		
		11	1 25	1	1 87			1	2 00			108	. . .	1 35				
		2	1 00	12	1 83			1	1 75			15	. . .	1 25				
				25	1 75			1	1 25			2	$75	. . .				
				2	1 50													
Total, 17.		Total, 35.		Total, 69.		Total, 16.		Total, 21.		Total, 52.		Total, 422.			Total, 18.		Total, 25.	

BLACKSMITHS.		MASONS.		SOLDERERS.			CAP-SOLDERERS.		BRICKLAYERS.		CAR-BUILDERS.		FAUCET-MAKERS.		LEAD BURNERS.		CANDLE MAKERS.		VARIOUS HELPERS.	
No.	Rate per day.	No.	Rate per day.	No.	Rate piece wages.	Rate per day.	No.	Rate per day.	No.	Rate per day.	No.	Rate per day.	No	Rate per day.	No.	Rate per day.	No.	Rate per day.	No.	Rate per day.
1	$3 00	6	$3 33	3	. . . .	$2 33	27	$2 50	10	$3 00	75	$1 65	28	$2 10	3	$4 67	9	$3 12	139	$2 66
1	2 75	10	3 25	6	. . . .	2 12	8	2 25	1	1 50									21	2 12½
7	2 53	7	3 00	7	. . . .	1 50														
4	2 50	10	1 62	22	$1 77	. . . .														
1	2 25	6	1 50																	
5	2 00																			
16	1 94																			
1	1 75																			
Total, 36.		Total, 39.		Total, 38.			Total, 35.		Total, 11.		Total, 75.		Total, 28.		Total, 3.		Total, 9		Total, 160.	

[TABLE LL.]

RANGE OF WAGES PAID IN MANUFACTURING PETROLEUM PRODUCTS, DURING THE YEAR ENDING DECEMBER 31, 1889.

(From data Eleventh United States Census.)

Rate per day.	No.	Rate per day.	No.	Rate per day.	No.	Rate per day.	No.	Rate per month.	No.
$8 91. . . .	6	2 92	6	2 20	11	1 66	34	$250	1
8 33. . . .	2	$2 86	67	2 18	30	1 65	126	240	1
8 00. . . .	3	2 85	4	2 17	24	1 64	3	208⅓	1
7 83. . . .	2	2 81	8	$2 15	39	1 62	444	166⅔	1
7 00. . . .	1	2 75	61	2 13	39	$1 61	7	150	3
6 00. . . .	3	2 73	19	2 12	137	1 60	23	125	14
5 48. . . .	1	2 70	21	2 10	29	1 57	137	117	1
5 41. . . .	13	2 68	4	2 09	6	1 55	16	110	4
5 00. . . .	5	2 67	1	2 08	111	1 50	2,120	108⅓	3
4 67. . . .	3	2 66	144	2 05	3	1 49	46	104⅙	4
4 50. . . .	4	2 65	28	2 03	23	1 42	55	100	10
4 33. . . .	3	2 63	64	2 02	13	1 40	160	90	1
4 17. . . .	2	2 62	15	2 01	1	1 35	124	83⅓	15
4 16. . . .	1	2 60	39	2 00	605	1 33	52	80	4
4 00. . . .	34	2 58	2	1 95	210	1 28	3	75	6
3 84. . . .	1	2 57	5	1 94	27	1 25	175	70	2
3 83. . . .	1	2 56	22	1 92	49	1 20	8	66⅔	3
3 75. . . .	11	2 55	13	1 90	161	1 17	2	62½	2
3 72. . . .	5	2 54	10	1 89	476	1 16	3	60	6
3 66. . . .	2	2 53	7	1 88	43	1 14	168	55	1
3 57. . . .	1	2 50	738	1 87	50	1 07	31	50	8
3 50. . . .	12	2 45	22	1 85	14	1 00	14	45	9
3 40. . . .	4	2 40	8	1 83	236	96	1	40	1
3 37. . . .	8	2 37	18	1 82	120	90	210	35	3
3 35. . . .	43	2 35	10	1 81	42	85	6	25	1
3 33. . . .	29	2 33	6	1 80	185	83	82		
3 30. . . .	220	2 32	2	1 78	214	80	29		
3 25. . . .	32	2 30	749	1 77	22	79	24		
3 20. . . .	2	2 29	7	1 76	23	75	57		
3 15. . . .	2	2 28	64	1 75	459	67	3		
3 12. . . .	9	2 27	50	1 71	3	62	15		
3 03. . . .	9	2 26	23	1 70	38	60	32		
3 00. . . .	194	2 25	398	1 69	19	58	10		
2 95. . . .	29	2 22	11	1 67	22	55	5		

Total number paid by the day, ...	11,052
Total number paid by the month, ...	105
Total number paid by the piece, ...	23
Classified total, ...	11,180
Unclassified, ...	1,356
Total employes manufacturing petroleum, ...	12,536

Statistics of Exports of Petroleum Products.

It seems almost incredible that the exports of petroleum products which, as the accompanying tables show, have now attained such enormous proportions, could have begun only thirty years ago. Messrs. Lockhart & Company, of Pittsburgh, have been generally considered the pioneers in the export business, having the distinction of sending the first American oil abroad, some 400,000 gallons, in 1862. But Mr. Allen Norton Leet, in one of his articles contributed to the *Oil, Paint and Drug Reporter*, claims that James Day sent 1,000 gallons of refined oil to Australia in 1859; and that Col. E. C. Ferris, in the same year, made shipments to South America, Germany and Italy. However this may be, there were no exports worthy of the name before 1863 or 1864; so that we are not making an overstatement in saying that the export trade in petroleum has reached its present proportions in the short space of thirty years.

For the tables that follow, we wish to acknowledge our indebtedness to the very admirable and complete records of the Bureau of Statistics of the United States Treasury Department. If their information on other exports are as accurate as that on petroleum, the work of this bureau cannot be too highly praised. We are also greatly indebted to the private records of the various branches of the Standard Oil Company; those giving the market quotations on export oils having been kindly placed at our disposal. We have been helped also by the records of the New York Produce Exchange.

Table MM. *Exports of petroleum, showitng the quantities and values of the different grades exported, and the countries to which they were sent, for the year ending June 30, 1890.*

Table NN. *Exports of petroleum, showing the quantities and values of the different grades exported, and the countries to which they were sent, for the year ending June 30, 1891.*

Table OO. *Exports of petroleum, showing the quantities and values of the different grades exported, and the countries to which they were sent, for the year ending June 30, 1892.*

Had the limits of this report permitted, we would have carried these tables back and given these exports for earlier years also.

Table PP. *Exports of illuminating oils, showing quantities, values and countries to which sent, from July 1, 1863, to June 30, 1892.*

By reference to table QQ, it will be seen that the exports of illuminating oils for the year ending June 30, 1890, were 523,29 ,090 gallons, valued at $38,640,638; for June 30, 1891, they were 571,119,805 gallons, valued at $40,221,201; and for June 30, 1892, 564,896,658 gallons, valued at $33,541,224. It will be noted that the year 1891 shows the largest quantity of illuminating oil exported, namely, 571,119,805 gallons; and that the year 1886 shows the largest value, namely, $40,634,331.

and that the year 1886 shows the greatest value; namely, $40,634,331.

The exports of illuminating oils were in 1866, three times those of 1864; those of 1868 were twice those of 1866, and six times those of 1864; those of 1871 were twice those of 1868, and twelve times those of 1864; those of 1877 were twice those of 1871, and twenty-four times those of 1864; those of 1891 were twice those of 1877, and forty-eight times those of 1864. In other words the exports of refined oils doubled themselves, beginning with 1866, in 1868; again in 1871; again in 1877; and again in 1891: so that those of 1891 were twice those of 1877, eight times those of 1868, sixteen times those of 1866, and forty-eight times those of 1864. Or to put it in another way, the average exports for every week of the year 1892 equalled the total exports for the whole year of 1864.

TABLE QQ. *Exports of illuminating oil by countries, showing percentage of total value sent to each country named, from July 1, 1863, to June 30, 1892.*

This table shows the relative value of the petroleum exports from America to the different geographical divisions of the globe. It is of interest to note the proportions of the shipments that went to each.

TABLE RR. *The petroleum exports by grades and shipping ports, from July 1, 1863, to June 30, 1892.*

This shows the quantity and value of each grade of petroleum exported—crude, refined oil, naphtha, lubricating oil and residuum—each year, from each of the principal delivery ports. We note with interest the growth of the shipments from Philadelphia. In 1864, they were twenty-one per cent. of the total from the whole United States. The percentage had increased to forty-three per cent. in 1866. By 1874, although the Philadelphia exports were seventeen times those of 1864, the percentage of the total was only thirty-five per cent. By 1882, although the Philadelphia exports were twenty-five times those of 1864, the percentage of the total was only twenty-two per cent. By 1891, although the Philadelphia exports were thirty-eight times those of 1864, the percentage was only twenty-seven per cent. By 1892, the Philadelphia exports had grown to forty-seven times those of 1864, and to thirty-two per cent. of the total from all ports.

TABLE SS. *Petroleum exports by grades, from July 1, 1863, to June 30, 1892.*

This table—better, perhaps, than any other except our table B which shows the same facts graphically to the eye—shows the phenomenal growth of the petroleum industry, particularly in the line of exports. In this connection we would call attention to the fact that a larger percentage of the oil product of the country is exported than that of any other product except cotton. The exports were 23,000,000 gallons, in 1864. By 1869 they had grown to 100,000,000 gallons; by 1874, they had grown to 200,000,000 gallons; by 1877, to 300,000,000

gallons; by 1880, to 400,000,000 gallons; by 1882, to 500,000,000 gallons; by 1889, to 600,000,000 gallons; by 1891, to 700,000,000 gallons.

Table TT.—*Petroleum exports from Philadelphia, showing quantities and values of each grade from July 1, 1863, to June 30, 1892.*

The exports from Philadelphia have increased from less than 5,000,000 gallons, valued at $2,000,000, in 1864, to over 231,000,000 gallons, valued at over $11,800,000, in 1892. From 1864 to 1874 there was a steady growth from 5,000,000 up to 88,000,000 gallons. Then came a decline, until, in 1878, the exports were less than 48,000,000 gallons 1882 shows nearly 125,000,000 gallons; 1887, over 156,000,000 gallons. 1888 and 1889 were smaller years, but 1890 shows a total of over 163,000,000 gallons; 1891, of over 190,000,000 gallons; while 1892 presents the largest exports on record—231,111,409 gallons, valued at $11,803,312.

Table UU.—*Exports of paraffine and paraffine wax, from July 1, 1880, to June 30, 1892.*

Trade in this product is of much more recent growth than in petroleum oils. Our table shows a similar increase. In 1881 the exports amounted to 5,369,821 pounds, valued at $437,187; those for 1891, to 66,366,003 pounds, valued at $3,714,649—that is, an increase of over 1200 per cent. for the 10 years.

Table VV.—*Average monthly and yearly export prices of crude oil, per gallon, in barrels, at New York.*

Table WW.—*Average monthly and yearly export prices of naphtha, per gallon, in barrels, at New York.*

Table XX.—*Average monthly and yearly export prices of refined oil, per gallon, in barrels, at New York.*

It seems fair to conclude from these tables that the reduction in prices has materially aided the natural value of petroleum products in the substantial increase in exports, shown by the preceding tables. The average price for refined oil for export for 1861 was $61\frac{1}{2}$ cents per gallon; for 1871, $23\frac{5}{8}$ cents; for 1881, 8 cents; for 1891, $6\frac{7}{8}$ cents; for 1892, 6 cents, or less than one-tenth that for 1861. But this decrease, large as it is, does not really represent the reduction in the price of the oil, as the figures given represent oil in barrels, and so include the cost of the package. The average price of the oil for 1861, deducting the barrel, would be not less than 58 cents; and for 1892, not more than $3\frac{1}{2}$ cents, or hardly one-seventeenth that of 31 years ago. In January, 1861, the price of a gallon of oil in bulk was 75 cents; in January, 1893, it was 3 cents, or, say one-twenty-fifth. This difference on a barrel of 50 gallons amounts to $36. The money that in 1861 was required to buy 1,000 barrels of oil will to-day purchase a bulk steamer load of of 25,000 barrels, or 1,250,000 gallons.

TABLE YY.—*Table to show the corresponding real specific gravity and the weight of one gallon of refined oil at 60 degrees temperature for each degree of the Baumé scale.*

The Baumé reading can be readily converted into real specific gravity by dividing 140 by the sum of 130 and the degree shown on the Baumé scale. Real specific gravity can be converted into Baumé by subtracting 130 from the result of a division of 140 by the degree of specific gravity shown.

[TABLE MM.]

EXPORTS OF PETROLEUM, SHOWING THE QUANTITIES AND VALUES OF THE GRADES EXPORTED AND THE COUNTRIES TO WHICH THEY WERE SENT, FOR THE YEAR ENDING JUNE 30, 1890.

(Compiled from data United States Treasury Department.)

	CRUDE OIL.		NAPHTHA.		REFINED OIL.		LUBRICATING OIL.		RESIDUUM.	
	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Barrels.	Dollars.
Argentine Republic,	.....	.....	47,020	9,508	3,113,750	339,070	300,490	93,252	....	....
Austria-Hungary,	3,297,291	212,684	.....	.....	.....	.....	40,243	11,104	....	....
Belgium,	.....	.....	303,520	26,300	41,391,323	2,221,947	1,955,145	249,926	....	....
Brazil,	.....	.....	24,419	4,135	8,695,291	876,641	128,301	49,031	10	55
Central America (Nicaragua),	.....	.....	946	122	258,899	31,261	6,066	1,829	16	69
Chile,	.....	.....	2,045	593	2,979,924	306,945	186,004	53,093	....	....
China,	532,250	49,499	.....	.....	13,072,000	1,251,201	2,669	1,888	....	....
Colombia,	.....	.....	16	7	554,483	70,694	17,970	6,702	678	3,066
Denmark,	.....	.....	.....	.....	7,147,115	496,243	43,598	8,120	....	....
Ecuador,	.....	.....	.....	.....	185,285	22,746	13,233	2,649	....	....
France,	68,947,436	4,491,120	4,195,704	364,477	2,088,291	155,270	3,088,183	454,205	....	....
French West Indies,	.....	.....	.....	.....	437,849	44,080	1,500	754	10	42
French East Indies,	.....	.....	.....	.....	1,012,520	92,625	250	250	....	....
French possessions in Africa and adjacent islands,	.....	.....	4,750	618	1,432,240	123,670	.....	.....	....	....
Germany,	1,188,266	59,259	2,015,298	159,834	140,264,089	7,766,452	3,670,937	566,495	22	53
England,	255	22	5,532,365	488,298	60,960 345	4,136,841	14,886,635	2,233,143	4,552	17,464
Scotland,	2,900	325	.....	.....	325,457	25,342	2,070,692	348,049	....	....

[TABLE MM]—*Continued.*

	CRUDE OIL.		NAPHTHA.		REFINED OIL.		LUBRICATING OIL.		RESIDUUM.	
	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Barrels.	Dollars.
Ireland,	.....	.....	71,629	6,449	5,107,444	387,737	78,120	8,382	.....	.....
Gibraltar,	191,350	18,561	.....	.....	804,000	74,502	3,500	763	.....	.....
Nova Scotia, New Brunswick and Pr. Edward's Is.,	.....	.....	2,406	266	2,198,385	222,608	163,444	33,002	27	113
Quebec, Ontario, Manitoba and N. W. Ter.,	22,040	2,403	31,424	4,726	2,128,453	197,229	81,009	22,608	.....	.....
British Columbia,	14,235	3,200	2,405	447	278,224	51,786	12,330	3,423	.....	.....
Newfoundland and Labrador,	.....	.....	.....	.....	499,802	42,781	15,556	5,195	10	37
British West Indies,	101	10	8,100	1,860	1,933,096	204,508	12,911	4,722	65	229
British Guiana,	.....	.....	.....	.....	1,134,212	112,096	6,485	2,506	.....	.....
British East Indies,	.....	.....	.....	.....	44,023,425	4,070,875	9,840	6,140	.....	.....
Hong Kong,	.....	.....	.....	.....	11,150,220	1,137,255	.....	.....	.....	.....
British possessions in Africa and adjacent islands,	.....	.....	6,114	1,968	3,870,732	453,262	14,155	4,122	.....	.....
British possessions in Australia,	.....	.....	45,161	11,202	7,976,572	970,768	378,005	77,022	.....	.....
Greece,	.....	.....	.....	.....	1,756,780	167,117	.....	.....	.....	.....
Hawaiian Islands,	.....	.....	.....	.....	752,900	94,653	14,350	5,447	4	18
Hayti,	.....	.....	.....	.....	202,646	30,659	3,452	1,538	86	365
Italy,	.....	.....	400	80	19,747,751	1,642,830	510,622	68,553	5,443	12,580
Japan,	.....	.....	53	18	37,892,930	3,559,375	51,991	14,405	.....	.....
Mexico,	2,217,846	193,320	9,120	1,586	1,754,748	197,648	125,505	34,826	64	375
Netherlands,	.....	.....	.....	.....	47,315,526	2,537,324	2,037,437	289,688	.....	.....
Dutch East Indies,	.....	.....	.....	.....	18,420,126	1,754,827	.....	.....	.....	.....
Peru,	.....	.....	.....	.....	201,980	24,105	39,998	14,368	4	16

Portugal,	50	5	4,695	674	4,287,262	359,240	10	11	. . . .	. . . .
Azore, Madeira and Cape Verde Islands,	. . . . .	. . . . .	. . . . .	. . . . .	249,973	22,600	. . . . .	. . . . .	. . . .	. . . .
Santo Domingo,	. . . . .	. . . . .	1,350	210	264,365	30,702	12,215	4,236	33	123
Spain,	13,934,088	1,253,228	10	4	169,400	16,400	36,636	6,027	. . . .	. . . .
Cuba,	4,913,330	446,618	10	3	228,730	31,511	74,251	32,660	41,775	84,922
Porto Rico,	. . . . .	. . . . .	738	189	1,123,251	131,433	611	269	6	24
Philippine Islands,	. . . . .	. . . . .	. . . . .	. . . . .	751,750	71,870	162	52	. . . .	. . . .
Spanish possessions in Africa and adjacent islands,	. . . . .	. . . . .	. . . . .	. . . . .	305,500	30,236	95	93	. . . .	. . . .
Sweden and Norway,	188,785	13,900	586,521	46,881	11,772,106	912,241	19,260	3,213	. . . .	. . . .
Turkey in Africa,	. . . . .	. . . . .	. . . . .	. . . . .	1,419,040	123,340	. . . . .	. . . . .	. . . .	. . . .
Uruguay	. . . . .	. . . . .	4,680	1,022	3,492,158	385,627	18,588	8,459	. . . .	. . . .
Venezuela,	. . . . .	. . . . .	. . . . .	. . . . .	973,130	109,261	10,590	4,627	62	303
All other countries,	430	81	36,489	3,322	5,189,612	521,204	19,478	6,490	51	216
Total,	95,450,653	6,744,235	12,937,433	1,134,799	523,295,090	38,640,638	30,162,522	4,763,347	52,916	120,070

[TABLE NN.]

EXPORTS OF PETROLEUM, SHOWING THE QUANTITIES AND VALUES OF THE GRADES EXPORTED AND THE COUNTRIES TO WHICH THEY WERE SENT, FOR THE YEAR ENDING JUNE 30, 1891.

(Compiled from data United States Treasury Department.)

	CRUDE OIL.		NAPHTHA.		REFINED OIL.		LUBRICATING OIL.		RESIDUUM.	
	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Barrels.	Dollars.
Argentine Republic	.....	.....	35,970	4,536	3,476,192	353,788	354,667	80,681	.....	.....
Austria-Hungary	1,753,652	95,136	.....	.....	716,912	39,867	15,960	2,020	.....	.....
Belgium	424,748	30,580	220,884	19,070	32,397,015	1,768,197	2,337,030	302,938	.....	.....
Brazil	.....	.....	26,989	4,589	10,470,656	1,047,612	218,171	73,726	.....	.....
Guatemala	.....	.....	200	65	212,944	28,125	3,663	1,533	13	60
Nicaragua	.....	.....	4,640	993	386,185	45,485	6,051	2,103	41	214
Salvador	.....	.....	40	12	166,995	24,353	1,434	718	.....	.....
Chile	.....	.....	3,788	673	1,606,135	162,315	186,388	56,554	.....	.....
China	.....	.....	.....	.....	27,160,660	2,586,321	20,518	5,339	.....	.....
Colombia	1,000	85	.....	.....	712,532	85,380	31,224	9,971	132	546
Denmark	.....	.....	54,420	3,783	9,135,043	556,575	68,956	9,857	.....	.....
Ecuador	.....	.....	200	55	284,177	31,152	2,786	1,614	2	8
France	61,663,973	3,485,659	2,831,929	234,155	3,764,974	279,295	3,948,257	537,508	1,500	7,400
French West Indies	.....	.....	.....	.....	381,512	37,685	10,009	3,449	1	5
French East Indies	.....	.....	.....	.....	1,992,630	187,454	200	130	.....	.....
French possessions in Africa and adjacent isl's	.....	.....	6,905	870	2,013,450	190,186	.....	.....	.....	.....
Germany	3,107,137	137,538	3,227,106	232,036	162,187,071	8,599,741	4,186,225	590,579	.....	.....
Great Britain and Ireland	.....	.....	5,058,325	421,126	81,028,529	4,820,834	18,767,573	2,553,646	7,552	18,549
Gibraltar	.....	.....	.....	.....	677,930	62,041	.....	.....	6	18

Nova Scotia, N. Brunswick, Prince Edw.'s Is.,			4,700	549	2,449,254	243,414	168,224	34,307	25	50
Quebec, Ontario, Manitoba and Northwest Ter.,	4,130	413	50,376	5,082	1,911,067	189,032	76,001	20,446	826	4,124
British Columbia,			3,892	741	283,155	56,482	45,553	13,680		
Newfoundland and Labrador,			101	15	586,783	47,865	8,994	2,505		
British West Indies,	8	2	10,460	2,373	2,056,168	216,112	19,630	6,456	53	228
British Guiana,					511,047	50,692	7,102	3,138		
British East Indies,					39,659,850	3,714,421	30,276	12,184		
Hong Kong,					10,814,630	1,040,208	3,780	1,191		
British possessions in Africa and adjacent isl's,			9,238	2,995	2,680,201	321,626	24,771	15,249		
British possessions in Australia,			54,905	13,973	10,276,095	1,149,898	446,598	96,679		
Greece,					1,679,640	158,540				
Hawaiian Islands,			100	13	1,313,140	179,191	22,621	8,812		
Hayti,	200	32	4,496	354	289,790	40,288	4,784	2,733	83	396
Italy,	100,000	9,100	200	36	20,955,728	1,495,511	591,996	74,031		
Japan,					31,000,629	2,878,861	53,063	15,716		
Mexico,	3,854,176	344,411	4,455	718	2,168,834	265,901	98,921	35,491	69	437
Netherlands,					54,879,032	2,794,315	1,504,623	194,582		
Dutch East India,					21,633,290	2,052,937				
Peru,					319,574	37,713	39,107	15,250		
Portugal,			4,400	549	5,035,331	417,267	4,235	487		
Azores, Madeira and Cape Verde Islands,					313,674	28,856				
Santo Domingo,			1,617	324	210,739	23,915	6,730	2,408	38	119
Spain,	17,103,416	1,485,552			90,212	8,238	16,363	3,278		
Cuba,	3,300,455	280,144	920	153	65,576	8,502	100,712	42,552	27,656	44,924
Philippine Islands,					1,004,400	96,564				
Spanish possessions in Africa and adjacent isl's,					320,860	30,651	208	111		
Sweden and Norway,	102,200	7,800	544,633	41,930	8,957,350	686,948	5,531	1,519		
Turkey in Europe,					245,832	22,199	120	60		
Turkey in Africa,					1,923,520	173,591	495	330		

[TABLE NN.]—EXPORTS OF PETROLEUM—*Concluded.*

	CRUDE OIL.		NAPHTHA.		REFINED OIL.		LUBRICATING OIL.		RESIDUUM.	
	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Barrels.	Dollars.
Uruguay	.....	.....	4,190	967	3,165,880	320,950	40,812	10,449	.....	.....
Venezuela	.....	.....	55	12	1,165,142	128,036	9,353	4,381	43	218
All other countries	.....	.....	1,103	309	4,381,840	430,073	25,015	8,212	26	126
Total	91,415,095	5,876,452	12,171,147	993,056	571,119,805	40,221,201	33,514,730	4,858 603	38,066	77,422

[TABLE OO.]

EXPORTS OF PETROLEUM, SHOWING THE QUANTITIES AND VALUES OF THE GRADES EXPORTED AND THE COUNTRIES TO WHICH THEY WERE SENT, FOR THE YEAR ENDING JUNE 30, 1892.

(Compiled from data United States Treasury Department.)

	CRUDE OIL.		NAPHTHA.		REFINED OIL.		LUBRICATING OIL.		RESIDUUM	
	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Barrels.	Dollars.
Austria—Hungary,	1.636.208	112,088	.....	.....	.....	.....	24,850	3,131	.....	.....
Belgium,	.....	.....	156,600	14.600	31.471,121	1,451.302	2,632,954	316,575	.....	.....
Denmark,	.....	.....	.....	.....	7,019.575	336,621	52.991	7.721	.....	.....
France,	69.100.657	3,045.461	1,561,284	101,916	3.005,535	205.560	2,461,722	406.204	4.902	25,600
Germany,	5.247.209	165,856	3,471,652	230,214	133.417.314	6,158,730	4.512.639	661,296	.....	.....
Gibraltar,	.....	.....	.....	.....	412,360	33 277	.....	.....	.....	.....
Greece,	.....	.....	.....	.....	1,324.000	100,379	.....	.....	.....	.....
Italy,	.....	.....	.....	.....	22.324.113	1,456,946	414,971	66.036	.....	.....
Netherlands,	.....	.....	.....	.....	76.607,180	3,288,860	2,229.116	289.473	.....	.....
Portugal,	.....	.....	7.690	915	4.063.230	282,392	64,050	6.827	.....	.....
Spain,	17.064.929	1.111.306	.....	.....	212,450	15.465	50,736	8,437	.....	.....
Sweden and Norway,	296.177	16,100	487.822	34,327	11,159.824	776.047	17,045	2.477	.....	.....
England,	2,629	181	6,798.390	489.200	86,288,272	4.179.439	16.867,366	2,554,300	1,459	4.569
Scotland,	.....	.....	.....	.....	238.962	27,147	1.910.840	262.614	.....	.....
Ireland,	.....	.....	15.026	1,539	8.374.543	564.235	1,600	192	.....	.....
Nova Scotia, New Brunswick and Prince Edward's Island,	.....	.....	3,050	415	2.687.884	259,363	112,457	24.217	.....	.....
Quebec, Ontario, Manitoba, etc.,	3.500	350	7,349	769	2,159,331	181,795	70.509	13,749	1.497	7,461
British Columbia,	.....	.....	7.253	1,370	283.511	48,403	42,712	12.318	.....	.....
Newfoundland and Labrador,	.....	.....	1.099	234	604,685	47,506	13,354	3.814	10	25
Guatemela,	.....	.....	240	74	193,773	25,873	9.612	3.334	.....	.....

[TABLE OO]—EXPORTS OF PETROLEUM—*Continued.*

	CRUDE OIL.		NAPHTHA.		REFINED OIL.		LUBRICATING OIL.		RESIDUUM.	
	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Barrels.	Dollars.
Nicaragua,	.....	.....	105	20	316,553	32,712	11,257	2,745	13	73
Salvador,	.....	.....	.....	.....	161,433	21,846	3,411	1,264	1	5
Mexico,	3,499,514	238,173	333	55	1,094,474	192.479	164,775	46,304	25	114
British West Indies,	.....	.....	1,130	319	2,001,008	176,055	19,459	6,535	66	300
French West Indies,	.....	.....	.....	.....	396,460	33,741	877	316	10	55
Hayti,	.....	.....	8,613	1,320	296,906	35,885	1,644	693	112	522
Santo Domingo,	.....	.....	1,300	217	369,742	34,024	10,618	4,164	17	60
Cuba,	6,316,406	378,216	1.250	240	235,362	24,802	171,554	69,880	4,801	6,204
Porto Rico,	421,848	33,905	250	77	708,488	64,219	5,334	2,256	.....	.....
Argentine Republic,	.....	.....	48,466	7,040	4,825,196	403,619	238,419	53,001	.....	.....
Brazil,	.....	.....	29,048	4,699	14,028,476	1,195 215	268,289	81.877	20	124
Chile,	.....	.....	7,550	2,080	3,662,758	296,061	193,557	53,382	20	67
Colombia,	3,696	204	2,040	226	709,884	70,605	34,326	11,323	108	420
British Guiana,	.....	.....	.....	.....	638,262	53,363	4,227	2,189	.....	.....
Peru,	.....	.....	520	146	279,435	26,685	32,437	12,160	15	49
Uruguay,	.....	.....	785	201	4,293,400	368,189	8,351	3.650	.....	.....
Venezuela,	.....	.....	1,100	282	1,155.539	112,322	11,895	4,967	61	322
China,	.....	.....	.....	.....	17,370,600	1,249,215	3,367	1,810	.....	.....
East Indies, British,	.....	.....	.....	.....	37,031,290	2,942,797	101.019	26,841	.....	.....
East Indies, Dutch,	.....	.....	.....	.....	17,017,200	1,302,676	.....	.....	.....	.....
East Indies, French,	.....	.....	.....	.....	1,858,920	139,720	.....	.....	.....	.....
Hong Kong,	.....	.....	3,800	660	16,529,790	1,304,380	910	347	.....	.....
Japan,	.....	.....	.....	.....	23,761,930	1,798.792	45,410	13,622	3	25

British possessions in Australasia, ...	103,592,767	5,101,846	12,727,978	912,921	564,896,658	33,541,224	33,591,076	5,203,550	13,270	46,657
Hawaiian Islands, ...			38,176	3,351	5,427,090	440,259	24,265	7,949	75	314
Philippine Islands, ...					1,540,190	111,734	2,000	1,200		
British possessions in Africa and adjacent islands, ...					2,054,770	162,012				
Canary Islands, ...			20	6	334,850	26,856	50	12		
French possessions in Africa and adjacent islands, ...			12,050	3,112	3,563,289	371,494	79,209	33,788	25	150
Egypt, ...					575,150	43,001				
All other countries, ...					433,690	51,216	19,094	7,780		198
Total, ...			53,987	13,239	10,376,260	1,015,859	643,778	112,100	35	

[TABLE PP.]

EXPORTS OF ILLUMINATING OIL, SHOWING QUANTITIES, VALUES AND COUNTRIES TO WHICH SENT, FROM JULY 1, 1863, TO JUNE 30, 1892.

(Compiled from data United States Treasury Department.)

YEAR ENDING JUNE 30.	1864.		1865.		1866.		1867.		1868.	
	QUANTITIES.	VALUES.	QUANTITIES.	VALUES.	QUANTITIES.	VALUES.	QUANTITIES.	VALUES.	QUANTITIES.	VALUES.
	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.
Europe—Great Britain and Ireland. . . .	3,526.675	1.886,770	3,065,232	2,200,163	9,234.112	4.798,626	17.156,671	5,930,395	8,106.116	2.301.794
Germany, ...	634,563	296.438	1,075,069	808,898	4.436.267	2,327.020	11.140,306	3,623,197	15.897.059	4.345.001
France, ...	1,366.750	628.272	1.670,805	1.135.267	1,773,112	1.003.522	4,639,176	1.639,203	4,773.104	1,340.208
Belgium, ...	2.240.150	1,128.930	2,557,092	1.844,075	7.288.257	3,972.360	12,668,372	4,600,036	11.093,636	3.233,455
Italy, ...	667,730	329,662	247,402	184,627	1.839.384	1,019,251	2,061.245	799.133	4,869,640	1,429.009
Netherlands, ...	514,113	262,349	302,051	208,807	740,855	417.756	2.921.019	984.416	4.200.729	1,319.209
Spain, ...	132.612	74,087	106,295	70.249	342,838	173,251	738,818	293.440	1,478,054	431,468
Russia,on Baltic and White seas.	346,692	174,685	181.452	135,726	1,627,083	831,865	867,608	282,019	2,098,153	598,240
Austria.	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	49,825	21,000	440,567	125,702
Portugal, ...	36.779	27,159	75,114	57,209	282,537	145,395	388,612	143.051	460.643	121,744
Sweden and Norway, ...	34,250	20,747	. . . . .	. . . . .	. . . . .	. . . . .	96,156	30,198	. . . . .	. . . . .
Denmark, ...	2,713	2,123	. . . . .	. . . . .	. . . . .	. . . . .	213,564	58,572	312.316	82,728
All other, ...	33,550	20.007	40,200	35.821	897,170	494.398	2,365,236	865,795	5,442.015	1,608,651
Total.	9,536,577	4,851,229	9.311.712	6.680,842	28,461.615	15,183,444	55,306,608	19,720.455	59.181.032	16.937.209
British—North American possessions, .	231,420	120.768	309,410	236,519	683.329	369,191	566,178	234,860	443.941	155,608

Mexico,	27.316	15,901	31,502	26.657	183.136	97.687	135.159	60.887	251,899	92,909
Central American States and British Honduras,	9.831	7.045	4,587	3.571	9,748	5.958	6,226	2.629	9,269	2.722
West Indies.	386.144	221.593	643,621	516.345	1.160.400	644.894	979.912	421,992	1.366.751	438.575
South America—Brazil.	298.316	192.369	173,965	144.751	723.582	367.300	431,205	181,556	747.785	249,758
Argentine Republic,	110,791	68.325	169,240	141.818	423,510	260,860	606.417	240,770	357.580	127,861
Venezuela.	50.454	33.053	18,347	13.910	72.641	45,304	67,591	25,594	63,374	22,470
U. S. of Colombia.	.....	.....	21,104	16,985	42,935	26.760	81,196	38.535	39,386	13.296
Uruguay.	.....	.....	21,845	18,063	85.582	52,205	75,700	30,855	157,040	54.907
Gulanas.	.....	.....	24.329	19.439	23.440	12,793	50.256	19.833	49,734	16,383
Chile.	87.537	55.010	11.200	10.335	168.320	107.306	360.543	171,457	219,160	66,065
Peru.	130.312	83.963	62.954	57.682	110.986	62.332	290,790	128,014	367,240	131,833
All other,	.....	.....	.....	.....	20.025	16,020	8.998	4,750	.....	.....
Total.	697.410	432,720	502,989	422,983	1,671,021	950.880	1,972.696	841,364	2,001,099	682.573
Asia and Oceanica—China.	9.899	5,728	2.790	2.535	49,914	29,165	72,120	32,296	129,760	38,952
British East Indies.	459,205	303,589	8.150	7.250	35,000	23.236	113,500	45,330	318,500	109,560
Japan,	.....	.....	.....	.....	2,000	1.000	.....	.....	32.000	12,848
British possessions in Australasia,	.....	.....	764.700	693.279	1.014,771	701,605	2,411.379	1,105.653	2,749,001	1.024,237
Hawaiian Islands.	10.497	7.756	9.140	8.638	20.000	12.985	18,100	8.896	23.300	9.642
Dutch East Indies.	.....	.....	4.000	3.800	6.000	4.320	42.230	19,012	138,000	48,320
Hong Kong.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
All other.	220	182	47.200	41,528	117,430	88,762	114,955	52.954	270.345	88.756
Total.	479.821	317,255	835,980	757.030	1.245,115	861.073	2,772.284	1,264,141	3,660.906	1.332.315
Africa.	278.230	121,456	42.583	39.159	91,086	53.538	380,464	168.375	302.530	108,583
All other countries.	.....	.....	3,190	2.305	4,427	2,521	6.034	2,480	4.962	1.649
Grand Total.	11.646.749	6.087.967	11.685.574	8.685,501	33.509,877	18,169.186	62.125,561	22.267.183	67.222.387	19,752,143

[TABLE PP.]—*Continued.*

YEAR ENDING JUNE 30.	1869.		1870.		1871.		1872.		1873.	
	QUANTITIES.	VALUES.	QUANTITIES.	VALUES.	QUANTITIES.	VALUES.	QUANTITIES.	VALUES.	QUANTITIES.	VALUES.
	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Gallons	Dollars.	Gallons.	Dollars.
Europe—Great Britain and Ireland. . .	11,040.062	3,559.402	8,386,112	2,558,490	15,144,670	3,812,828	10,088,136	2,483.074	15,741,151	3,539.548
Germany, ...	21,500.841	6,823,078	31,241,137	9,330,822	34,381,678	8,523.866	35,055,780	8,325,381	52.113,733	11.469,151
France.	4.261,982	1.370.901	2,925,090	906.556	2,277,229	552,376	2.121,914	510,644	705,182	186,470
Belgium, ...	12,932,081	4,185,478	15,022,980	4.582,184	17,384.603	4,295.037	16.363,278	3.880.509	22,616,550	5.127,408
Italy.	7,069,735	2,424,817	4,263,618	1.351,199	7,020.027	1,952.528	6,036,303	1,561,316	6,147,649	1,558.139
Netherlands, ...	4,672.663	1,491,362	6,976,595	2.145.205	7,890,367	2,015.223	10,153.494	2,439,003	9,676.174	2,217,511
Spain.	2.357.139	779,519	4.032,542	1.236.220	5,111,826	1,348,028	5,031,920	1,276,719	6,331.657	1,591,821
Russia, on Baltic and White seas, ...	3,894.249	1,283,575	2,023,389	592,005	7,162.091	1.854,805	5.327,704	1,367,407	7,403,860	1,667.781
Austria, ...	1,085.851	365,675	2.106.771	630,453	3.462,611	898,843	2,623,654	645,868	2.496,945	563.225
Portugal.	1,065,781	349.904	910,043	276,564	1.017,042	253,470	1.188,511	272,378	1,171,754	267,163
Sweden and Norway, ...	343,610	111,228	108,562	31,368	550,335	145,431	1.832,012	427,061	1.817,824	378,387
Denmark.	1,387,688	460,158	1,068,244	295.471	. . . . .	1.442.390	2,346,894	574,314	5,971,331	1,278,600
All other, ...	6,464.392	2,169,325	9,419,391	2.919.923	14,035,521	3,740,781	12,228,452	3,213,201	9.349,014	2,434,190
Total, ...	77.807,074	25.374,422	88,484,474	26.856,460	121.201,190	30,835,606	110,398,052	26.977,875	141.542,824	32,279,394
British North American possessions, . .	574,315	198,042	638,952	201.540	460.612	130,360	405,611	123.307	498,806	132,506
Mexico, ...	171.851	64,657	457.870	157,034	303.824	90.073,	538.346	172,280	430,829	143,149
Central American States and British Honduras.	4.896	1,890	1,619	486	12,948	4.180	24.273	8,479	21,770	6.991

West Indies,	1,865,728	658,242	2,562,262	811,864	2,585,072	703,641	2,520,501	721,567	2,607,982	735,017
South America—Brazil.	813,672	278,885	1,506,053	464,559	1,256,990	353,028	1,475,780	417 764	2,083,411	701,198
Argeutine Republic.	151,994	51,565	429,146	138,476	572,704	161,576	470,323	139,136	964,150	288,240
Venezuela,	91,256	32,331	67,894	21,993	84,907	25,431	113,029	33,318	164,908	45,406
U. S. of Colombia,	64,220	22,346	113,100	34,173	219,501	61,380	147,991	48,874	167,827	51,761
Uruguay.	35,150	11,772	185,479	57,867	546,966	162,238	785,904	230,207	562,240	160,302
Gulanas,	.....	.....	.....	.....	.....	.....	.....	.....	104,287	29,449
Chile,	336,270	124,117	255,628	87,307	525,405	164,290	309,080	90,974	427,300	126,939
Peru,	53,856	19,018	294,703	92,057	359,846	-104,923	303,389	89,162	208,110	63,563
Total.	1,546,418	540,034	2,852,003	896,432	3,566,319	1,032,866	3,605,496	1,049,435	4,682,233	1,466,858
Asia and Oceanica—China.	108,770	36,417	470,187	142,399	984,150	55,490	702,280	207,528	971,053	290,426
British East Indies.	81,000	28,622	73,000	27,460	165,720	55,362	720,470	209,750	60,000	18,050
Japan.	4,480	2,140	.....	.....	.....	.....	117,250	38,855	463,550	131,709
British possessions in Australasia,	1,649,346	604,253	1,530,259	507,003	2,443,647	735,275	2,589,585	792,615	2,672,140	806,102
Hawaiian Islands.	13,770	6,069	22,960	9,127	22,500	8,600	28,450	11,627	59,690	24,454
Dutch East Indies,	45,792	16,567	235,263	63,400	509,680	149,975	18,000	5,400	807,020	234,405
Hong Kong,	.....	.....	.....	.....	.....	.....	.....	.....	1,353,702	97,364
All other.	.....	.....	.....	.....	.....	.....	.....	.....	.....	370,916
Total,	1,903,158	694,068	2,331,669	749,389	3,325,697	1,004,702	4,176,035	1,265,175	6,717,403	1,973,426
Africa,	45,264	19,535	214,116	73,078	251,072	77,009	242,376	69,239	1,261,899	363,507
All other countries,	215,788	80,152	359,540	117,910	902,221	260,299	628,885	178,751	345,668	94,887
Grand total.	84,403,492	27,631,042	97,902,505	29,864,193	132,608,955	34,138,736	122,539,575	30,566,108	158,102,414	37,195,735

[TABLE PP—*Continued.*]

YEAR ENDING JUNE 30.	1874.		1875.		1876.		1877.		1878.	
	QUANTITIES.	VALUES.	QUANTITIES.	VALUES.	QUANTITIES.	VALUES.	QUANTITIES.	VALUES.	QUANTITIES.	VALUES.
	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.
Europe—Great Britain and Ireland. . . .	26,079,008	4,353.405	22,258.297	3.036,360	25.201,057	3.420.692	31,629.227	7,035.438	36,650,663	5.219,215
Germany, ...	72,398,842	11.730,861	63,153,516	8,092,491	66,056,328	8.559,859	87,357,471	17.262,964	85,632.598	11.460,476
France, ...	1,971,742	329,382	2.022,408	223.557	1.174,330	127,328	361.235	71,157	. . . . .	. . . . .
Belgium, ...	34,101,776	5,506.531	28,601,255	3,656,989	32.329.030	4,182.963	30,164,924	6,503,681	37,958,310	4,989,693
Italy, ...	9,189,952	1,745.580	8.543.761	1,310.819	10,591.551	1,590.911	11,421.725	2.460,377	15.972,383	2.368.549
Netherlands, ...	13,901.156	2.385.917	10,109,370	1.270.790	12,245,288	1,589,142	8.600.646	1,752.652	14.906.499	1.984.535
Spain.	5.544.146	1.009.990	5,921,550	886,349	6,991,823	1.065.088	10,792.755	2.391,184	8.901.411	1,241,154
Russia,on Baltic and White seas.	7.022.720	1.194.847	3.819.717	608,160	6.299,349	905.252	4.729,806	734,250	1.954,643	288.126
Austria, ...	3,774,883	630.410	3,704,112	457.956	5,356.627	696.051	8,703,104	1,841.091	9,115,164	1,313,257
Portugal.	1.297,589	210.329	957,807	122.935	1,020.249	134.377	1,653.479	363.525	1,747.220	247.678
Sweden and Norway.	1,412.650	218,422	2,624.709	342,263	2.076.503	271.841	6,942.305	1,168,868	4,397.154	599,845
Denmark, ...	6.532,362	1.050.083	5,324 949	697.431	4.760.380	651.446	12,434,489	2,175,723	9.743,904	1.291,597
All other.	1.207,137	2,198.931	5.842.547	896,754	5,945.549	929.602	10,769.899	2.514.504	11,045.500	1,747.968
Total.	194,433.963	32,564.688	162,883.998	21.602,854	180,048.064	24.124,552	225.561,065	46.275,414	238.025.449	32,752,093
British North American Possessions. . .	699,077	155.418	908,301	142,325	790,199	131,578	826,646	198,594	1.252,836	215.168
Mexico.	623,626	164.160	465.662	108.368	759.984	171.348	784.102	221.894	805,087	173.438
Central American States and British Honduras.	21,172	5.827	41.349	10.990	55.448	11.982	43.280	14.656	97.145	20,518

West Indies.	3,320.947	685,433	3,131.822	547.984	3,664.204	629,301	3.887,172	892,539	3,263,873	541.455
South America—Brazil.	2.075,894	467,943	2,999,652	574,307	2.680.805	498.294	3.539,733	901.025	3.802,594	655.797
Argentine Republic. . .	657.500	139.550	278.975	52,060	766,500	144.197	850.972	228,374	1,656.889	282.720
Venezuela.	194,689	41.667	250,333	44,200	293,123	52.008	330.669	78.048	341,385	61.275
U. S. of Colombia. . .	186.587	42,446	193,699	38,529	177,285	36,178	172.512	43,936	465,460	78,894
Uruguay, ...	325.260	69,385	444,000	80.641	378.640	73,132	676.020	148,541	551,966	95.094
Gulanas.	171.331	36,416	236.144	42.208	211,025	38,406	281,951	65.252	550,220	86.870
Chile.	733,100	168,745	641.820	119,871	441,910	84,413	591,150	132,962	650.920	111.891
Peru, ...	257,230	55,074	515.331	102,263	242,807	45,482	316.635	72.252	513.534	86,417
All other, ...	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	13,580	2.117
Total.	4,601.591	1,021.236	5 559.954	1.054.079	5.192.095	972.110	6.759,642	1,669.390	8,546.540	1,460.175
Asia and Oceanica—China.	827,510	196,041	2,120,790	410,599	937.392	177,369	1.327,970	317,704	3.671,007	597.269
British East Indies.	1.001.360	224.346	1.232,070	236.675	690,000	141,150	1.872,923	510,579	3.036,990	532.137
Japan.	526.150	120,065	2.585,030	502,824	2,123,854	399.676	2,148.551	494.323	7.944,728	1.305.713
British Possessions in Australasia. . .	3,692.951	811,442	2,128.355	434.956	2,314.279	467.950	3,242,392	867.990	4.588.615	841,271
Hawaiian Islands,	61,093	17,219	43,740	10,745	23,120	5.429	87,721	28,700	140,370	32.488
Dutch East Indies, .	1,959.710	429,569	4.858,340	960,650	5.093.599	619.891	10.502, 954	2,606,646	8,158,100	1,414.594
Hong Kong. . . .	120	60	250.590	46,886	265.060	51.816	218.700	54.100	582,000	98.125
All other, ...	2.091.366	447,341	1,933,083	344,710	1.832,159	318.331	1,833.889	425,085	3,411.780	575,486
Total.	10.160.260	2.246.083	15,151.998	2,948,045	11.279,454	2,173,612	21.235,100	5.299,127	31,533.590	5,397,033
Africa.	2.674,537	578,881	3.131,900	565.893	2.868,904	509,638	3.054,133	764,600	4,950,313	826,198
All other countries.	685.331	139.229	276,949	49,823	156,321	31,517	290,704	64,918	739.700	127,570
Grand total, ...	277,220,504	37,560,955	191,551,933	27,030.361	204.814.673	28,755,638	262.441.844	55,401.152	289.214,541	41,513,676

[TABLE PP—*Continued.*]

YEAR ENDING JUNE 30.	1879.		1880.		1881.		1882.		1883.	
	QUANTITIES.	VALUES.	QUANTITIES.	VALUES.	QUANTITIES.	VALUES.	QUANTITIES.	VALUES.	QUANTITIES.	VALUES.
	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.
Europe—Great Britain and Ireland. . . .	34,751,409	3,637,609	48,832,070	3,829,174	47,310,213	4,691,581	70,934,445	5,880,495	60,689,023	5,037,743
Germany.	102,422,272	10,168,432	113,024,559	8,664,098	91,980,568	8,538,570	123,728,566	9,694,187	118,781,859	9,219,609
France, ...	1,656,209	192,957	338,979	25,544	749,015	63,843	2,517,752	206,618	2,122,804	162,002
Belgium.	41,445,848	4,099,858	37,058,778	2,845,852	32,980,373	3,056,104	46,956,099	3,674,948	43,852,218	3,354,772
Italy.	16,565,508	1,936,191	16,998,347	1,636,354	12,751,966	1,466,075	24,982,611	2,609,149	14,318,657	1,384,194
Netherlands.	17,564,344	1,753,584	21,556,667	1,657,121	18,941,326	1,856,375	21,663,293	1,672,336	23,648,441	1,849,370
Spain, ...	6,630,770	747,089	6,651,382	603,422	3,359,296	347,695	2,406,509	247,509	880,676	82,886
Russia on Baltic and White Seas.	3,141,915	336,685	1,274,660	109,379	1,029,573	99,755	2,502,655	216,416	1,232,180	103,817
Austria, ...	12,612,780	1,326,107	16,530,306	1,257,797	15,232,161	1,498,181	24,180,311	1,951,773	15,734,103	1,177,494
Portugal.	2,290,284	230,590	2,198,915	181,982	2,682,622	265,689	3,049,060	262,082	2,530,287	219,545
Sweden and Norway, ...	6,528,181	659,167	4,730,840	377,852	10,573,473	990,630	9,427,287	773,196	6,040,846	497,948
Denmark, ...	10,838,392	1,082,102	6,593,515	510,452	15,499,204	1,464,490	13,948,322	1,092,539	11,102,877	872,790
All other.	9,851,448	1,262,589	7,838,230	769,881	14,988,791	1,738,059	18,252,307	1,970,327	6,205,938	626,810
Total.	266,299,360	27,432,960	283,627,248	22,468,905	267,898,581	26,077,047	364,549,217	30,251,575	307,140,909	24,588,710
British North American Possessions, . .	1,285,213	170,532	1,037,349	125,349	1,571,297	220,543	3,299,396	383,944	3,255,069	370,760
Mexico, ...	936,487	152,438	1,128,083	155,328	1,128,155	173,555	1,472,766	226,115	1,755,835	249,404
Central American States and British Honduras, ...	147,597	21,372	135,638	16,902	231,402	32,276	288,111	39,947	184,441	23,662

West Indies.	3,365,421	419.608	2.939,590	317,700	3,745.120	462,858	4,642,497	509,002	2,939.599	345.230
South America—Brazil.	4.222,110	558.524	3,909.097	438,327	5,556,728	753,362	5.473,525	663,575	6.065,728	667,444
Argentine Republic. . .	943.470	117,192	1.432,777	158.956	1,158,400	146.510	1,257,648	146,112	1.815.526	188,782
Venezuela.	360.605	45.269	412,858	45,980	462.924	59,548	395.364	47,945	643.028	75.818
U. S. of Colombia. . .	192.358	27,619	458,342	51.108	429,897	61.196	233,747	31,793	272.054	36,314
Uruguay, ...	636.790	81,116	781,630	88.946	1,292,635	156.742	1,375.550	155.280	1,496,500	165,830
Guianas.	775.233	97.205	433.775	45.687	467,926	60.081	583.426	73,349	651.240	77,758
Chile.	832.500	107.052	927,750	99.002	645,970	87,421	1,188 700	138.987	2.025,100	219,859
Peru, ...	601.115	76.589	145.682	12.933	113.000	13,805	287.500	33,131	421.300	45.266
All other.	26.500	3,240	19,147	2.264	21,000	2,497	85.450	9,691	120.011	14.360
Total.	8.590,681	1,113.806	8,521,058	943,203	10,148,480	1.341,162	10,880.910	1,299.863	13,510.487	1,491,431
Asia and Oceanica—China.	5.443.000	690.358	3.576.866	366,367	4,553.200	554,898	9,682.340	1.064.243	6.093.460	639.377
British East Indies,	6.900.460	926,285	17.425.080	1.999,605	6,608.770	828,362	25,747.500	2.983 987	19.031.410	2.017.511
Japan.	15,295.570	1.959.643	13.559.381	1.405,165	7,078.100	853,173	17,768,830	2,000,796	22,955.802	2.553,482
British Possessions in Australasia. . .	2.791.789	469.028	4,461.667	550.784	3.707,029	555,691	5,199.110	740.467	3.901.124	528.219
Hawaiian Islands. .	119,856	21,760	155.054	31.684	275,400	50.157	318,870	44,798	431,375	62.300
Dutch East Indies	10.682.370	1.381.565	22,343,746	2,488,684	13.530,504	1.670.790	22.432,588	2,596.223	22.466.375	2,360,853
Hong Kong, ...	390,000	45.894	493.000	57,493	1.671.300	204,879	3,708.700	411.958	4.218.460	459.604
All other.	2.734.760	343.361	1,627,050	160,854	2,060,802	271,906	4.318,210	471,859	3.839,361	373,176
Total.	44,357.805	5.837.894	63,641,844	7,060.636	39,485,505	4.989.856	89.206.157	10.314.331	82,937.367	8.994.522
Africa.	6,032.997	766.765	5.733.963	623.045	6,859,723	873.179	12.349,946	1,388.701	6.349.966	672,152
All other Countries.	570.881	75.087	561.050	72.507	1,214.782	147,619	1.524,033	175.376	1.747.408	190.703
Grand total.	331.586.442	35.999.862	367.325.823	31,783,575	332.283,045	34.317,695	488,213.033	44.588.854	419.821,081	36.926,574

[TABLE PP—*Continued.*]

YEAR ENDING JUNE 30.	1884.		1885.		1886.		1887.		1888.	
	QUANTITIES.	VALUES.	QUANTITIES.	VALUES.	QUANTITIES.	VALUES.	QUANTITIES.	VALUES.	QUANTITIES.	VALUES.
	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.
Europe—Great Britain and Ireland, . .	48.781.791	4,323.588	62,911,717	5,284.840	73,447,181	6.180,411	71.627,222	5,318.987	68,787,549	5.121.227
Germany, ...	107.703.735	8.975,387	97,688.264	7.391.939	98.894.755	7,752,121	118,629.066	7,995,150	113,415,233	7.229,342
France, ...	1.864.772	159.347	104,950	8.428	520.836	39,787	4.913.742	334,036	2,048,441	155,101
Belgium, ...	42.732,079	3,561,188	48.529,333	3,810,679	48.371.109	3.833.852	44,226,813	3,012,092	45,765.138	3.254,456
Italy, ...	19,818,242	1,995.860	27.252.992	2,530.122	16.019,428	1,471,048	24.846,473	2.098,980	18.962,744	1.668,445
Netherlands.	24.445.076	2.053,927	25.781,510	2.047,597	38,794.144	3.066,215	44,727,434	3.068.051	34.252,908	2,402,118
Spain, ...	758.864	71.677	1,814,103	112.141	96	29	84,000	7.190	544,900	47.653
Russia,on Baltic and White seas,	529,156	42,815	213.120	16,942	275,047	20,848	. . . . .	. . . . .	105.233	7,785
Austria.	12.839,742	1,051.314	7,265,610	567,167	1,421.008	113,267	543,719	41.974	290.505	23,147
Portugal, ...	2,675.904	231.841	3,388,146	282,622	2.607,920	227.126	3,207,673	237,062	3,749.699	301.046
Sweden and Norway.	6,493.682	546,434	7,978,871	650.575	8,258.596	669.447	8,395.176	616.865	7.264,587	534.364
Denmark, ...	11.432.673	937,457	9.228,768	735,572	9.443.660	734,894	5,890.518	394.490	4,485,778	326.337
All other, ...	11.054.571	1.107,230	9,449,759	868.617	5,857.918	546,722	6,170,564	521,883	5,954.203	518,751
Total, ...	291,130.287	25.058.065	301,607,143	24,607,241	303,911,698	24,655,767	333,262,400	23.646.740	305,606.918	21,589,772
British North American Possessions, . .	3.323,536	372.495	3,893.200	405.662	3,596.142	392.617	4,958,657	493.512	5.151,454	494.608
Mexico.	1,444.002	197,552	1.623,770	224,492	1,266.943	175,186	2,173.677	254,929	1.154.775	151.738
Central American States and British Honduras.	405.005	52.374	367,739	48.852	426.822	54,583	565.156	67.951	603,051	74,802

West Indies,	2.870,304	350.154	3.518.781	385.657	3,547,565	395,105	4.231.281	457.034	3.902,849	453,339
South America—Brazil.	5,034.114	532,782	8.163,077	814,497	6,037.565	607,312	7,651.290	741.230	7.901,463	779.824
Argentine Republic.	2.111,620	240.315	3.638.710	366,085	2,398.656	240.618	4,140.630	393,022	3,177,465	334,839
Venezuela.	721.311	77.597	702.279	74.544	613,171	60.762	773,736	78.353	792,131	82.533
U. S. of Colombia,	402.676	50.469	383.372	41,954	482.477	55,388	658.443	68,805	636,724	72.380
Uruguay.	1,507.661	161.131	2.456,780	246.060	1.813.023	180,715	2.547.470	242,989	2,257,290	235,604
Guianas,	491,166	55,878	605,771	63.269	618.380	63,364	694.470	64.680	664,533	65.725
Chile,	953.073	104.747	1.437,792	142.825	2,178.696	221,589	2.040,637	192,497	1.751.295	168.776
Peru,	295.909	30.210	337.455	31.490	602,618	56.084	195,290	19.436	441,621	43.965
All other.	50.690	5.680	8.340	848	179,210	20.894	251,560	28,436	105,450	11,416
Total.	11,568.220	1,258.809	17.733.576	1,781.572	14.923.796	1,506.726	18,953,526	1,829.448	17.727.972	1.795,062
Asia and Oceanica—China.	8.383.830	835,949	15.421,150	1.454,979	26,272,320	2.417,160	7,263,822	635,448	10,732,810	1,045.701
British East Indies,	32,437.460	3,334,918	37,339.930	3.562,533	42,475.477	3.869.365	39,705.603	3,495.105	33.378,221	3.045,668
Japan,	18,005.350	1.849.453	19.739,043	1.861.183	24,259,270	2.282.307	21.983.462	1,951,962	26.384.490	2.473,668
British Possessions in Australasia,	4.306.367	576,915	7.315,365	912.986	7.734,790	968,436	4,380,859	537,473	9,356,439	1.098,183
Hawaiian Islands.	419.480	51,370	362.320	42,660	507,255	82,511	774.227	90.310	710,160	75,189
Dutch Indies,	20,217.493	2,085,495	20,745.431	2,024.732	22,338.260	2.119,612	23.843,569	2,161,507	25.013,010	2.328,290
Hong Kong.	4,856.250	505.376	7,725.330	714,399	6.820.380	613.750	2.808.700	240,309	4,470,880	421.385
All other,	6.065.659	606,836	7,033,743	671,096	4,290.756	398,160	5,240.660	462.069	5.043,325	473,312
Total.	94.691.889	9.843.339	115,682,312	11,244.568	134,698,508	12,751,301	106.000,902	9,574,183	115.089,035	10.961,396
Africa,	7.732.002	799,920	11.275,640	1,119,483	5.425,556	534.428	8.392,230	776,575	6.920.074	661,088
All other countries.	2.450,448	262.641	2.541.031	257,300	1,674,481	168.618	2.307.982	203.625	331,093	33.605
Grand total.	415.615.693	38.195,349	458.243,192	40,074,827	469,471.451	40,634,331	480.845.811	37.303,997	456.487.221	36,215.410

[TABLE PP—*Concluded.*]

YEAR ENDING JUNE 30.	1889.		1890.		1891.		1892.	
	QUANTITIES.	VALUES.	QUANTITIES.	VALUES.	QUANTITIES.	VALUES.	QUANTITIES.	VALUES.
	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.
Europe—Great Britain and Ireland,	65,368,602	4,971,602	66,393,246	4,549,920	81,028,529	4,826,834	94,901,777	4,770,821
Germany,	138,518,352	8,455,898	140,264,089	7,766,452	162,187,071	8,599,741	133,417,314	6,158,730
France,	2,602,061	191,034	2,088,291	155,270	3,764,974	279,295	3,005,535	205,560
Belgium,	38,800,535	2,609,275	41,391,323	2,221,947	32,397,015	1,768,197	31,471,121	1,451,302
Italy,	18,825,621	1,727,534	19,747,751	1,642,830	20,955,728	1,495,511	22,324,113	1,456,946
Netherlands,	41,158,182	2,716,886	47,315,526	2,537,324	54,879,032	2,794,315	76,667,780	3,288,860
Spain,	183,216	17,248	169,406	16,400	90,212	8,236	212,450	15,465
Russia, on Baltic and White Seas,	119,690	8,430	.....	.....	.....	.....	112,130	7,208
Austria,	723,670	50,941	.....	.....	716,912	39,867	.....	.....
Portugal,	4,186,838	348,393	4,287,262	359,240	5,035,331	417,267	4,063,230	282,392
Sweden and Norway,	10,212,572	768,468	11,772,106	912,241	8,957,350	686,948	11,159,824	776,047
Denmark,	4,137,271	301,881	7,147,115	496,243	9,135,043	556,575	7,019,575	336,621
All other,	5,307,893	484,296	2,560,780	241,619	2,603,402	242,780	2,062,230	156,625
Total,	330,144,503	22,654,351	343,136,889	20,899,486	381,750,599	21,715,566	386,357,079	18,906,577
British North American Possession,	5,247,155	513,677	5,104,864	514,404	5,230,259	536,793	5,888,503	551,076
Mexico,	2,123,532	226,165	1,754,748	197,648	2,168,834	265,901	1,094,474	192,479
Central American States and British Honduras,	603,462	82,548	258,899	31,261	766,124	97,963	957,633	109,948
West Indies,	3,896,191	430,196	4,189,937	427,893	3,003,785	326,502	4,262,935	392,428

South America—Brazil,	8,834,260	890,012	8,695,291	876,641	10,470,656	1,047,612	14,028,476	1,195,215
Argentine Republic,	5,952,415	619,877	3,113,750	339,070	3,476,192	353,788	4,825,196	403,619
Venezuela,	1,036,272	113,363	973,130	109,261	1,165,142	128,036	1,155,539	112,322
United States of Colombia,	573,307	72,624	554,483	70,694	712,532	85,380	709,884	70,605
Uruguay,	2,523,820	267,171	3,492,158	385,627	3,165,880	320,950	4,293,400	368,189
Gulanas,	651,259	67,505	1,134,212	112,096	511,047	50,692	893,172	75,398
Chile,	2,035,946	208,974	2,974,924	306,945	1,606,135	162,315	3,662,758	296,061
Peru,	425,055	46,924	201,980	24,105	319,574	37,713	279,435	26,685
All other,	67,020	8,321	185,285	22,746	284,177	31,152	127,026	10,196
Total,	22,099,354	2,294,774	21,330,213	2,247,185	21,711,335	2,217,638	29,974,886	2,558,290
Asia and Oceanica—China,	9,848,960	907,479	13,072,000	1,251,201	27,160,660	2,586,321	17,370,600	1,249,215
British East Indies,	41,834,151	3,734,276	44,023,425	4,070,875	39,659,850	3,714,421	37,031,290	2,942,797
Japan,	32,791,090	3,069,778	37,892,930	3,559,375	31,000,629	2,878,861	23,761,930	1,798,792
British Possession in Australasia,	7,551,161	958,027	7,976,572	970,768	10,276,095	1,149,898	10,376,260	1,015,859
Hawaiian Islands,	380,630	50,778	752,900	94,653	1,313,140	179,191	433,690	51,216
Dutch Indies,	22,939,540	2,181,964	18,420,126	1,754,827	21,633,290	2,052,937	17,017,200	1,302,676
Hong Kong,	6,720,810	640,606	11,150,229	1,137,255	10,814,530	1,040,208	16,529,790	1,304,380
All other,	7,708,310	711,376	1,764,270	164,495	2,997,030	284,018	4,520,776	341,651
Total,	129,774,652	12,244,284	135,052,443	13,003,449	144,855,324	13,885,855	127,041,536	10,006,586
Africa,	6,384,803	656,274	7,027,512	730,508	6,938,031	716,054	8,865,999	785,753
All other countries,	1,983,803	184,064	5,439,585	543,804	4,695,514	458,029	453,613	38,087
Grand total,	502,257,455	39,286,333	523,295,090	38,640,638	571,119,805	40,221,201	564,896,658	33,541,224

[TABLE QQ.]

EXPORTS OF ILLUMINATING OIL BY COUNTRIES, SHOWING PER CENT. OF TOTAL VALUE SENT TO EACH COUNTRY NAMED, FROM JULY 1, 1863, TO JUNE 30, 1892.

(Compiled from data United States Treasury Department.)

YEAR ENDING JUNE 30	EUROPE.			BRITISH NORTH AMERICA.			MEXICO, CENTRAL AMERICAN STATES AND BRITISH HONDURAS.			WEST INDIES.			SOUTH AMERICA.		
	Gallons.	Dollars.	Per cent. of total value.	Gallons.	Dollars.	Per cent. of total value.	Gallons.	Dollars.	Per cent. of total value.	Gallons.	Dollars.	Per cent. of total value.	Gallons.	Dollars.	Per cent. of total value.
1864,	9.536,577	4,851,229	79.68	231,420	120,768	1.98	37.147	22.946	.38	386,144	221,593	3.64	697.410	432,720	7.11
1865,	9.311,712	6.680,842	76.92	309,410	236,519	2.72	36.089	30,228	.35	643.621	516,435	5.95	502.989	422.983	4.87
1866,	28,461.615	15.183.444	83.56	683.329	369.191	2.03	192.884	103,645	.57	1.160,400	644.894	3.55	1,671.021	950.880	5.23
1867,	55.306.608	19,270.455	86.53	566.178	234.860	1.05	141,385	63.516	.29	979.912	421,992	1.90	1 972.696	841.564	3.78
1868,	59,181.082	16,937.209	85.76	443.941	155,608	.78	261,166	95,631	.48	1.366.751	438,575	2.22	2,001,099	682,573	3.45
1869,	78.076,074	25.374,422	91.84	574.315	198,042	.71	176.747	66,547	.24	1.865,728	658.242	2.38	1,546.418	540.034	1.96
1870,	88,484,474	26.856,460	89.94	658.952	201,540	.67	459.489	157.520	.53	2,562,262	811,864	2.72	2,852,003	896.432	3.00
1871,	121,201,190	30,835.606	90.32	460,612	130.360	.38	316.772	94.253	.28	2,585,072	703,641	2.06	3.566.319	1,032.866	3.03
1872,	110.398,052	26,977.875	88.25	405,611	123,307	.41	562.619	180.759	.59	2.520,501	721,567	2.36	3.605.496	1,049,435	3.43
1873,	141.542.824	32.279,394	86.77	491.806	132,506	.36	452,599	150.140	.40	2,607.982	735.017	1.98	4.682.233	1.466.858	3.94
1874,	194.433,963	32.564.688	86.70	699,077	155.418	.41	644.798	169,987	.45	3,320.947	685,433	1.83	4,601.591	1.021.236	2.72
1875,	162,883,998	21.602.854	79.92	908.301	142,325	.53	507.011	119.358	.44	3,131.822	547,984	2.03	5,559.954	1,054,079	3.90
1876,	180,048,064	24,124,555	83.88	790.199	131,578	.46	815.432	183,330	.64	3.664.204	629.301	2.19	5,192,095	972.110	3.38
1877,	225.561,965	46.275,414	83.53	826.646	198.594	.36	827.382	236.550	.43	3,887,172	892.539	1.61	6,759.642	1,669.390	3.01
1878,	238.025.449	32.752,093	78.90	1.252.836	215.168	.52	902.232	196,956	.44	3,263.873	541,433	1.31	8.546,548	1.460.175	3.52
1879,	206,299,360	27.452.960	76.21	1.285.213	170.532	.45	1.084.084	173.810	.48	3,365,421	419,008	1.17	8.590,681	1,113.806	3.10

1880, ...	283,627,248	22,468,905	70.70	1,037,349	125,349	.39	1,263,721	172,230	.54	2,939,590	317,700	1.00	8,521,058	943,203	2.97
1881, ...	267,898,581	26,077,047	75.98	1,571,297	220,543	.64	1,359,557	205,431	.60	3,745,120	462,858	1.35	10,148,480	1,341,162	3.91
1882, ...	364,549,217	30,251,575	67.84	3,299,396	383,944	.86	1,760,877	266,062	.60	4,642,497	509,002	1.14	10,880,910	1,299,863	2.92
1883, ...	307,140,909	24,588,710	66.58	2,255,069	370,760	1.00	1,940,276	273,066	.74	2,939,599	345,230	.94	13,510,487	1,491,431	4.04
1884.	291,130,267	25,058,065	65.60	3,323,536	372,495	.98	1,849,007	249,926	.65	2,870,304	350,154	.92	11,568,220	1,258,809	3.30
1885.	301,607,143	24,607,241	61.41	3,893,200	405,662	1.01	1,991,509	273,344	.68	3,518,781	385,657	.96	17,733,576	1,781,572	4.45
1886.	303,911,698	24,655,767	60.68	3,596,142	392,617	.97	1,693,765	229,769	.57	3,547,505	395,105	.97	14,953,756	1,506,726	3.71
1887.	333,262,400	23,646,740	63.39	4,958,657	493,512	1.32	2,738,883	322,880	.86	4,231,281	457,034	1.22	18,953,826	1,829,448	4.90
1888.	305,606,918	21,589,772	59.61	5,151,454	494,608	1.36	1,757,826	226,540	.62	3,902,849	456,339	1.25	17,727,972	1,795,062	4.96
1889, ...	330,144,503	22,654,351	57.66	5,274,155	513,677	1.31	2,726,994	208,713	.79	3,896,191	431,196	1.09	22,099,354	2,294,774	5.84
1890.	343,136,889	20,899,486	54.09	5,104,864	514,404	1.33	2,013,647	228,909	.59	4,189,937	472,893	1.23	21,350,213	2,247,185	5.81
1891.	381,750,599	21,715,566	54.00	5,230,259	536,793	1.33	2,934,958	363,864	.90	3,603,785	326,502	.81	21,711,335	2,217,638	5.51
1892, ...	386,357,079	18,906,577	56.37	5,888,503	551,076	1.64	2,052,107	302,427	.90	4,262,935	392,428	1.17	29,974,886	2,558,290	7.63

[TABLE QQ—*Continued.*]

YEAR ENDING JUNE 30.	ASIA AND OCEANICA.			AFRICA.			ALL OTHER COUNTRIES.			TOTAL.	
	Gallons.	Dollars.	Per cent. of total value.	Gallons.	Dollars.	Per cent. of total value.	Gallons.	Dollars.	Per cent. of total value.	Gallons.	Dollars.
1864,	479,821	317,255	5.21	278,230	121,456	2.00	.....	.....	.....	11,646,749	6,087,967
1865,	835,980	757,030	8.71	42,583	39,159	.45	3,190	2,305	.03	11,685,574	8,685,501
1866,	1,245,115	861,073	4.74	91,086	53,538	.30	4,427	2,521	.02	33,509,877	18,169,186
1867,	2,772,284	1,264,141	5.68	380,464	168,375	.76	6,034	2,480	.01	62,125,561	22,267,183
1868,	3,660,906	1,332,315	6.75	302,530	108,583	.55	4,962	1,649	.01	67,222,387	19,752,143
1869,	1,903,158	694,068	2.51	45,264	19,535	.07	215,788	80,152	.29	84,403,492	27,631,042
1870,	2,331,669	749,389	2.51	214,116	73,078	.24	359,540	117,910	.39	97,902,505	29,864,193
1871,	3,325,697	1,004,702	2.94	251,072	77,009	.23	902,221	260,299	.76	132,608,955	34,138,736
1872,	4,176,035	1,265,175	4.14	242,376	69,239	.23	628,885	178,751	.59	122,539,575	30,566,108
1873,	6,717,403	1,973,426	5.31	1,261,899	363,507	.98	345,668	94,887	.26	158,102,414	37,195,735
1874,	10,160,260	2,246,083	5.98	2,674,537	578,881	1.54	685,331	139,229	.37	517,220,504	37,560,955
1875,	15,151,998	2,948,045	10.91	3,131,900	565,893	2.09	276,649	49,823	.18	191,551,933	27,030,361
1876,	11,279,454	2,173,612	7.56	2,868,904	509,638	1.78	156,321	31,517	.11	204,814,673	28,755,638
1877,	21,235,100	5,299,127	9.56	3,054,133	764,600	1.38	290,704	64,918	.12	262,441,844	55,401,132
1878,	31,533,590	5,397,083	13.00	4,950,313	826,198	2.00	739,700	127,570	.31	289,214,541	41,513,676
1879,	44,357,805	5,837,894	16.22	6,032,997	776,765	2.16	570,881	75,087	.21	331,586,442	35,999,862
1880,	63,461,844	7,060,636	22.21	5,733,963	623,045	1.96	561,050	72,507	.23	367,325,823	31,783,575
1881,	39,485,505	4,989,856	14.54	6,859,723	873,179	2.55	1,214,782	147,619	.43	332,283,045	34,317,695
1882,	89,206,157	10,314,331	23.13	12,349,946	1,388,701	3.12	1,524,033	175,376	.39	488,213,033	44,588,854
1883,	82,937,367	8,994,522	24.36	6,349,966	672,152	1.82	1,747,408	190,703	.52	419,821,081	36,926,574
1884,	94,691,889	9,843,339	25.77	7,732,002	799,920	2.09	2,450,448	262,641	.69	415,615,693	38,195,349

1885.	115,682,312	11,244,568	28.05	11,175,640	1,119,483	2.79	2,541,031	257,300	.64	458,248,192	40,074,827
1886.	134,608,508	12,751,301	31.38	5,425,556	534,428	1.31	1,674,481	168,618	.41	469,471,451	40,634,331
1887.	106,000,902	9,574,183	25.67	8,392,230	776,575	2.08	2,307,982	203,625	.55	480,845,811	37,303,997
1888.	115,089,035	10,961,396	30.28	6,920,074	661,088	1.83	331,093	33,605	.09	456,487,221	36,215,410
1889.	129,774,652	12,244,284	31.17	6,384,803	656,274	1.67	1,983,803	184,464	.47	502,257,455	39,286,333
1890.	135,052,443	13,003,449	33.65	7,027,512	730,508	1.89	5,439,585	543,804	1.41	523,296,040	38,640,638
1891.	144,855,324	13,885,855	34.53	6,938,031	716,054	1.78	4,695,514	458,929	1.14	571,119,805	40,221,201
1892.	127,041,566	10,006,586	29.84	8,865,999	785,753	2.34	453,613	38,087	.11	564,896,658	33,541,224

[TABLE RR.]

PETROLEUM EXPORTS BY GRADES AND SHIPPING PORTS, FOR EACH YEAR ENDING JUNE 30, FROM JULY 1, 1863, TO JUNE 30, 1892.

	CRUDE PETROLEUM.		REFINED PETROLEUM.								TOTAL.	
			NAPHTHAS.		ILLUMINATING OILS.		LUBRICATING OILS.		RESIDUUM.			
	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.
Philadelphia, ...	2,087,114	670,774	13,167	4,842	2,878,148	1,413,597	None.	None.	None.	None.	4,983,429	2,089,213
New York, ...	8,443,631	3,605,780	157,076	62,592	6,729,408	3,508,867	"	"	"	"	15,330,115	7,177,239
Baltimore, ...	338,324	140,032	146,956	41,066	223,257	127,518	"	"	"	"	708,537	308,616
Boston, ...	. . . . .	. . . . .	90,158	40,732	1,691,726	974,485	"	"	"	"	1,781,884	1,015,217
All other ports, . . .	256,364	124,045	25,840	4,859	124,210	63,500	"	"	"	"	406,414	192,404
Total, 1864, . .	11,125,433	4,540,651	438,197	154,091	11,646,749	6,087,967	"	"	"	"	23,210,379	10,782,689
Philadelphia, ...	1,110,907	488,751	43,992	9,640	3,886,019	2,704,960	None.	None.	None.	None.	5,040,918	3,203,351
New York, ...	11,872,595	6,994,009	61,060	29,541	6,001,318	4,466,718	"	"	"	"	17,934,973	11,490,268
Baltimore, ...	72,996	60,721	272,090	87,228	314,963	248,781	"	"	"	"	660,049	396,730
Boston, ...	7,700	8,551	97,705	41,674	1,363,668	1,171,931	"	"	"	"	1,469,073	1,222,156
All other ports, . . .	266,130	151,937	6,100	5,860	119,606	93,111	"	"	"	"	391,836	250,908
Total, 1865, . .	13,330,328	7,703,969	480,947	173,943	11,685,574	8,685,501	"	"	"	"	25,496,849	16,563,413
Philadelphia, ...	5,096,037	1,639,991	164,198	25,771	16,701,452	8,864,555	None.	None.	None.	None.	21,961,687	10,530,317
New York, ...	11,290,623	4,616,171	67,272	13,007	13,593,592	7,382,346	"	"	"	"	24,951,487	12,011,524
Baltimore, ...	170,442	82 583	271,301	94,567	1,129,508	624,789	"	"	"	"	1,571,251	801,939

Boston.	5.602	1,801	147.400	43.660	1,608,221	1,015.968	"	"	"	"	1,761,223	1.061.429
All other ports. . . .	241,283	132,330	23,306	11,820	477,104	281,528	"	"	"	"	741,693	425.678
Total. 1866. . .	16.803,987	6.472.876	673,477	188,825	33,509,877	18.169,186	"	"	"	"	50,987.341	24.830,887
Philadelphia, ...	3,047,117	658,875	117.977	13.989	26,717,294	9,497,274	None.	None.	None.	None.	29.882.388	10.152.138
New York.	4,463,004	1,299,311	15.884	2.854	31,020,482	11,032,154	"	"	"	"	35,499.370	12.334,319
Baltimore.	157.264	64,499	29.886	3,444	2.485,462	879,197	"	"	"	"	2.672.612	947,140
Boston, ...	26,152	11,701	52.581	10.068	1,725,561	789,838	"	"	"	"	1,804,294	811,667
All other ports, . . .	211,807	71,898	8.248	3,820	176.762	86,720	"	"	"	"	396,817	162.438
Total, 1867. . .	7,905,344	2,106,284	224.576	34.175	62.125.561	22,267.183	"	"	"	"	70.255.481	24.407.642
Philadelphia, ...	3.778.871	622,677	1,144.481	196,915	23,738,410	8,035.771	None.	None.	None.	None.	33,661.762	8,855.363
New York, ...	5,910,462	811,374	122.545	23.725	35,125,703	10.539,066	"	"	"	"	41.158,710	11.374,165
Baltimore, ...	764.121	255,702	20.495	3.847	666.837	183,601	"	"	"	"	1,451,453	443,150
Boston.	30,939	5,725	220.147	42.546	2.526,803	924,574	"	"	"	"	2.777.889	972,845
All other ports. . . .	232,840	95,182	9,600	840	164,634	69.131	"	"	"	"	407.074	165.153
Total. 1868. . .	10.717.233	1.790,660	1.517.268	267.873	67.222,387	19,752,143	"	"	"	"	79.456,888	21.810,676
Philadelphia.	1.409,603	289.202	2.313,675	384,560	33.037,974	10,397,507	None.	None.	None.	None.	36.761.252	11.071,269
New York.	10.986,193	2.338,777	113.263	21,336	46,890.138	15,529.478	"	"	"	"	57,989,594	17.889.591
Baltimore, ...	1.010,661	360,792	. . . . .	. . . . .	1,179.026	396.379	"	"	"	"	2,189.687	757,171
Boston.	7,090	969	167.796	27.446	1,946,705	802.782	"	"	"	"	2.121,591	831,197
All other ports, . . .	12.019	4.664	78.360	12,428	1.349,649	504,896	"	"	"	"	1,440.028	521.988
Total 1869, . . .	13,425.566	2,994,404	2,673.094	445.770	84.403.492	27.631.042	"	"	"	"	100.502.152	31,071.216
Philadelphia.	3.005,916	608,415	360.054	36.948	36.147,670	11,016,757	None.	None.	None.	None.	39.513.640	11.662.120
New York.	6,573,688	1,364,062	4,862,769	499.540	59.211,486	17.951,557	"	"	"	"	70.647,943	19,815.159
Baltimore.	656.726	191,146	. . . . .	. . . . .	857.421	260,974	"	"	"	"	1.514,147	452,120
Boston.	1,000	500	196,151	27.709	1.436,204	557,921	"	"	"	"	1.633,355	586.150
All other ports. . . .	165.984	73,169	3,630	667	249.724	76,984	"	"	"	"	419,338	150.820
Total 1870, . . .	10.403.314	2.237.292	5.422.604	564,864	97,902.505	29.864,193	"	"	"	"	113.728.423	32.666.349

[TABLE RR—*Continued.*]

	CRUDE PETROLEUM		REFINED PETROLEUM								TOTAL.	
			NAPHTHAS.		ILLUMINATING OILS.		LUBRICATING OILS.		RESIDUUM.			
	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.
Philadelphia.	2,588,007	442,944	760,243	73,776	49,428,659	12,266,195	None.	None.	None.	None.	52,776,909	12,782,915
New York, ...	6,291,139	1,143,322	6,263,219	648,282	80,346,184	21,005,710	"	"	"	"	92,900,542	22,797,314
Baltimore.	754,365	287,732	. . . . .	. . . . .	1,074,235	281,173	"	"	"	"	1,828,600	568,905
Boston, ...	. . . . .	. . . . .	178,602	22,781	1 583,601	529,470	"	"	"	"	1,762,203	552,251
All other ports. . . .	225,527	97,849	7,528	1,958	176,276	56,188	"	"	"	"	409,331	155,995
Total 1871, . . .	9,859,038	1,971,847	7,209,592	746,797	132,608,955	34,138,736	"	"	"	"	149,677,585	36,857,380
Philadelphia, ...	5,951,795	999,064	1,237,767	156,204	48,763,900	11,566,468	36	45	69,678	6,352	56,023,176	12,728,133
New York, ...	7,403,322	1,270,145	6,853,213	775,346	70,097,897	17,970,342	112,175	42,626	266,238	28,603	84,732,845	20,087,062
Baltimore, ...	197,339	35,568	185	28	2,104,433	522,278	152,854	56,274	21,000	2,100	2,475,811	616,248
Boston.	1,700	488	40	20	1,266,951	389,693	258,913	104,677	5,292	495	1,532,896	495,373
All other ports. . . .	5,612	1,846	1,430	562	306,394	117,327	17,441	7,665	75,978	4,174	406,855	131,574
Total 1872, . . .	13,559,768	2,307,111	8,092,635	932,160	122,539,575	30,566,108	541,419	211,287	438,186	41,724	145,171,583	34,058,390
Philadelphia.	4,981,872	821,449	1,686,577	242,852	62,420,325	13,825,920	4,773	1,265	395,262	40,827	69,488,809	14,932,313
New York, ...	13,418,695	2,173,588	7,909,918	1,227,547	91,347,338	22,268,003	257,554	103,216	253,344	29,190	113,186,849	25,801,544
Baltimore, ...	. . . . .	. . . . .	80,751	7,552	2,611,840	579,369	265,682	93,279	. . . . .	. . . . .	2,958,273	680,200
Boston, ...	. . . . .	. . . . .	65,667	9,193	1,434,420	411,472	220,185	79,970	1,050	75	1,721,322	500,710
All other ports, . . .	38,840	15,013	680	295	288,491	110,971	505	236	131,418	9,474	459,934	135,989
Total 1873. . . .	18,439,407	3,010,050	9,743,593	1,487,439	158,102,414	37,195,735	748,699	277,966	781,074	79,566	187,815,187	42,050,756

Philadelphia. . . .	4,395,953	473,020	1,593,398	157,612	81,950,259	13,258,005	13,944	2,189	134,400	11,388	88,087,954	13,902,214
New York.	13,367,003	1,624,697	7,898,742	859,104	129,213,255	23,121,059	578,890	188,638	1,382,430	114,174	152,440,320	25,907,672
Baltimore.	. . . . .	. . . . .	222,603	17,937	3,081,443	504,447	509,169	160,845	69,300	4,538	3,882,515	687,767
Boston.	. . . . .	. . . . .	1,480	336	2,582,369	554,242	136,746	51,330	. . . . .	. . . . .	2,720,595	605,908
All other ports. . . .	13,463	1,979	21,235	3,633	393,178	123,202	5,556	1,241	241,668	12,199	675,099	142,254
Total 1874, . . .	17,776,419	2,099,696	9,737,457	1,038,622	217,220,504	37,560,955	1,244,305	404,243	1,827,798	142,299	247,806,483	41,245,815
Philadelphia. . . .	3,662,247	324,116	1,830,696	147,018	52,411,429	6,724,172	200	50	304,752	17,353	58,209,324	7,212,709
New York.	11,055,615	1,081,814	9,405,412	948,698	118,825,486	17,507,286	388,545	104,611	2,391,186	166,790	142,066,244	19,809,199
Baltimore.	. . . . .	. . . . .	400,329	33,717	17,608,320	2,281,732	376,677	82,280	54,180	2,580	18,439,506	2,400,309
Boston.	. . . . .	. . . . .	81,180	8,118	2,227,142	397,545	400,966	124,119	. . . . .	. . . . .	2,709,288	529,782
All other ports, . . .	252	88	41,323	3,889	479,556	119,626	7,085	2,586	2,730	380	530,946	126,569
Total 1875. . . .	14,718,114	1,406,018	11,758,940	1,141,440	191,551,933	27,030,361	1,173,473	313,646	2,752,848	187,103	221,955,308	30,078,568
Philadelphia, ...	8,663,564	873,592	3,250,942	294,492	60,770,244	7,958,189	20,998	5,369	278,166	19,736	72,983,914	9,151,378
New York, ...	10,675,183	1,218,916	11,149,727	1,113,994	111,505,878	16,239,022	462,432	151,068	2,286,564	171,905	136,079,784	18,894,905
Baltimore, ...	1,178,080	127,353	376,051	33,671	28,728,948	3,799,190	93,660	20,120	8,358	738	30,385,097	3,981,072
Boston.	. . . . .	. . . . .	480	90	2,110,477	380,159	366,378	119,469	. . . . .	. . . . .	2,477,335	499,718
All other ports, . . .	3,570	407	3,036	564	1,699,126	379,078	19,974	7,837	8,316	827	1,734,022	388,713
Total 1876. . . .	20,520,397	2,220,268	14,780,236	1,442,811	204 814,673	28,755,638	963,442	303,863	2,581,404	193,206	243,660,152	32,915,786
Philadelphia, ...	4,262,093	558,101	3,499,300	378,412	50,823,652	10,757,806	22,269	6,143	466,368	43,142	59,073,682	11,743,604
New York.	21,127,100	2,988,996	10,915,337	1,363,433	165,327,149	35,017,416	907,456	273,481	2,592,996	259,567	200,870,038	39,902,893
Baltimore.	1,111,617	171,200	633,105	64,224	35,876,575	7,472,443	165,206	41,421	75,684	6,122	37,862,187	7,755,410
Boston.	. . . . .	. . . . .	87,093	9,145	3,671,122	860,418	440,644	151,823	. . . . .	. . . . .	4,198,859	1,021,386
All other ports. . . .	318,392	38,432	5,348	1,468	6,743,346	1,293,049	65,490	24,672	61,572	8,524	7,194,148	1,366,145
Total 1877, . . .	26,819,202	3,756,729	15,140,183	1,816,682	262,441,844	55,401,132	1,601,065	497,540	3,196,620	317 355	309,198,914	61,789,438
Philadelphia. . . .	4,809,278	471,871	1,994,067	156,796	40,795,553	5,605,117	28,697	8,037	178,878	13,598	47,806,473	6,255,419
New York.	19,347,620	1,911,694	13,986,554	1,224,000	198,134,569	29,001,711	1,475,219	398,556	3,526,866	284,706	236,470,828	32,820,667
Baltimore, ...	1,803,138	176,816	429,873	29,175	41,740,233	5,539,865	196,124	51,229	. . . . .	. . . . .	44,169,368	5,797,085

[TABLE RR—*Continued.*]

	CRUDE PETROLEUM.		REFINED PETROLEUM.								TOTAL.	
			NAPHTHAS.		ILLUMINATING OILS.		LUBRICATING OILS.		RESIDUUM.			
	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.
Boston,	.....	.....	737	155	3,841.942	654,738	548.440	162.337	.....	.....	4,391,119	817,230
All other ports,	976,691	133 637	5,390	1,686	4.702,244	712.245	56.144	19,222	263.046	17.783	6.003.515	884.573
Total 1878,	26,936.727	2.694,018	16,416.621	1.411,812	289,214.541	41,513.676	2,304.624	639,381	3,968.790	316.087	338,841,303	46,574,974
Philadelphia,	4.687.786	377,197	2,729,037	207.928	76.307,729	7.795.749	7.182	3,367	144.564	7,952	83,876,298	8.392,193
New York,	17.716.883	1.517.701	11.477.029	987.145	206,520.009	23,088,504	1,709,556	452,257	2,684,052	173.563	240.107,529	26.219.170
Baltimore,	1,166,825	98.292	600,782	42.500	32.662.045	3.231,700	269,759	56.249	216.342	12,693	34.915.753	3,441,434
Boston,	.....	.....	52,750	4,623	5,090.871	640,553	478,998	134,903	.....	.....	5.622,619	780,079
All other ports,	2,302.934	187.223	194,763	16,584	11.005,788	1.243.356	22,186	8,692	262,080	16.518	13,787,811	1.472,373
Total 1879,	25.874.488	2.180,413	15,054.361	1.258,780	331,586.442	35,999.862	2,487,681	655,468	3.307,038	210,726	378.310.010	40.305.249
Philadelphia,	2,730,147	160.549	2,366,622	148,464	77,083,630	6.234,608	34.943	6,980	395.094	28.161	82,610.436	6.578,762
New York,	24,034.260	1,652,200	15,257.520	996,398	266,841.227	23.489,496	4,151.597	822.388	3.885.588	217.677	314.170.192	27,178.159
Baltimore,	.....	.....	682,702	36.200	17,921,548	1,399.975	367.240	68,713	416,430	24,000	19,387.920	1,528.888
Boston,	500	65	385	93	4.611.433	507.511	600.837	137,378	.....	.....	5.213,155	645,047
All other ports,	1,533.090	114.393	103.815	11,074	867.985	151,985	8.218	3.665	69.888	6,652	2,582.996	287.769
Total 1880,	28,297.997	1.927.207	18.411.044	1,192.229	367,325.823	31.783.575	5.162,835	1.039.124	4,767,000	276,490	423.964,699	36.218,625
Philadelphia,	5,326.528	351.736	1.084.324	95,516	55,076.090	5,480,763	154,836	30.199	.....	.....	61,641.778	5.958.214
New York,	34,032.428	2.661.708	16,103.509	1,581,154	254,300.615	26.334,965	3,854.572	843.214	3,080,364	175.682	311,371.488	31.596,723
Baltimore,	.....	.....	.....	.....	13,881.990	1.327.989	266.237	50.167	150,528	7.000	14,298.755	1,385,156
Boston,	7,156	687	26.954	2.779	7.808,194	962.437	572,922	128,695	1,386	317	8,416,612	1.094,915

All other ports, . . .	618.732	51,333	77,523	14,526	1,216,156	211,541	3,636	1,789	15,582	1,412	1.931,629	280,601
Total 1881. . . .	39.984,844	3,065,464	17,292,310	1,693,975	332,283,045	34,317,695	4.852,203	1,054,064	3.247.860	184,411	397,660,262	40,315,609
Philadelphia, ...	4,454,946	288,581	3,172,703	273,848	116,322,337	9,993,305	764,363	134,443	109,410	7,258	124,823,759	10,697,435
New York, ...	36,326,586	2,802,955	16,941,538	1,515,809	342,424,705	31,794,515	5,249,902	1,235,846	3,107,328	179,709	404,050,059	37,528,834
Baltimore, ...	. . . . .	. . . . .	. . . . .	. . . . .	18,188,946	1,438,189	147,997	24,522	492,828	25,500	18,829,771	1.488,211
Boston, ...	. . . . .	. . . . .	13,860	3,081	8,903,437	1,022,455	275,122	76,282	. . . . .	. . . . .	9,192,419	1,101,818
All other ports, . . .	523,465	37,975	84,997	16,405	2,373,608	340,390	70,716	21,303	5,796	335	3,058,582	416,408
Total 1882. , . .	41,304.997	3,129,511	20,213,098	1,809,143	488,213,033	44,588,854	6,508,100	1.492,396	3,715,362	212,802	559,954,590	51,232,706
Philadelphia, ...	6,959,240	460.857	1,752,328	104,117	65,212,757	5,567,659	963,602	163,720	240,366	15,882	75,128,293	6,312,235
New York, ...	45,470,118	3,433,182	15,160,531	1,166,332	335,183,695	29,447,160	8,697.040	2,029,199	5,668,236	409,984	410,179,620	36,485.857
Baltimore, , ...	. . . . .	. . . . .	. . . . .	. . . . .	10.983,808	871,447	95,652	16,098	227,976	15,573	11,307,436	903,118
Boston, ...	. . . . .	. . . . .	13,274	3,658	6,115,060	702,599	290,309	73,485	. . . . .	. . . . .	6,418,643	779,742
All other ports, . . .	282,948	20,902	144,404	28,179	2,325,761	337,709	135,739	44,130	8,778	1,207	2,897,630	432,127
Total 1883, . . .	52,712,306	3,914.941	17,070,537	1,302,286	419.821,081	36.926.574	10,182,342	2.326,632	6.145,356	442,646	505,931,622	44,913,079
Philadelphia, ...	5,557,310	400,833	854.219	49,052	75,919,774	6,935,975	998,373	198,428	176,736	9,050	83,506,412	7,593,338
New York, ...	61.622,893	4,901,448	14,059,549	999,075	322,108,400	29.514,016	9,065,085	1,858,081	4,470,060	308,512	411,325,987	37,581,132
Baltimore, ...	. . . . .	. . . . .	. . . . .	. . . . .	11,076,970	923,946	99,697	16,045	630,882	32.247	11,807,549	972,238
Boston, ...	. . . . .	. . . . .	9,084	1,875	4,580,010	536,969	246,290	71,904	10,164	960	4,845,548	611,708
All other ports, . . .	6,126	693	122,559	22,649	1,930,539	284,443	106,090	35,137	9,282	1,910	2,174,596	344,832
Total, 1884, . .	67,186,329	5.302,974	15.045,411	1,072,651	415,615,693	38,195.349	10,515,535	2,179,595	5.297,124	352,679	513,660,092	47,103,248
Philadelphia, ...	29,542,316	2,082,561	5,726,160	406,263	111,705,564	9,264,065	582,241	90,560	1,278,480	63,137	148,834,761	11,906,586
New York, ...	51,494,832	3,821,162	9,986,223	844,496	322,795,541	28,603,340	11.782,165	2,394,847	3,881,808	246,383	399,940,569	35,910.228
Baltimore, ...	. . . . .	. . . . .	. . . . .	. . . . .	12,728,398	1,007,129	127,623	27,592	1,398,768	64,234	14,254,789	1,098,955
Boston, ...	. . . . .	. . . . .	510	141	8,573,089	859,177	403,774	86,832	84	31	8,977,457	946,181
All other ports, . . .	844	110	109,960	21,390	2,440.600	341,116	106,680	33,052	2,520	329	2,660,604	395,997
Total, 1885 . .	81,037,992	5,903.833	15,822,853	1,272.290	458.243,192	40,074,817	13,002,483	2.632,883	6,561,660	374,114	574,668,180	50,257,947

[TABLE RR—*Continued.*]

	CRUDE PETROLEUM.		REFINED PETROLEUM.								TOTAL.	
			NAPHTHAS.		ILLUMINATING OILS.		LUBRICATING OILS.		RESIDUUM.			
	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.
Philadelphia, ...	33,452,742	2,327,344	4,866 220	344,925	116,126,657	9,628,165	288,465	43,445	840,042	52,480	155,574,126	12,396,359
New York, ...	46,545,119	3,513,491	7,236 729	618,636	329,092,679	28,768,592	11,712,072	2,345,527	1,134,000	72,586	395,720,599	35,318,832
Baltimore.	25,995	1,626	. . . . .	. . . . .	11,144,211	822,052	35,133	7,402	1,249,458	63,528	12,454,797	894,608
Boston.	10,000	830	3,280	680	7,568 087	771,394	152,486	35,946	. . . . .	. . . . .	7,733,853	808,850
All other ports, . . .	212,907	16,286	204,968	33,179	5,539,817	644,128	337,913	87,295	2,772	307	6,298,377	781,195
Total, 1886. . .	80,246,763	5,859,577	12,311,197	997,420	469,471,451	40,634,331	12,526,069	2,519,615	3,226,272	188,901	577,781,752	50,199,844
Philadelphia, ...	35,892,185	2,204,847	4,945,780	393,632	113,959,691	8,566,164	276,858	38,539	1,445,430	68,924	156,519,944	11,272,106
New York, ...	40,162,009	2,654,894	10,690,102	964,645	332,372,082	25,970,393	16,162,890	3,003,103	1,101,450	55,268	400,488,533	32,648,303
Baltimore.	5,075	250	. . . . .	. . . . .	11,607 138	828,016	113,986	11,299	701,946	32,387	12,428,145	871,952
Boston, ...	. . . . .	. . . . .	6,763	2,055	6,414,154	596,404	157,310	32,654	. . . . .	. . . . .	6,658,227	631,113
All other ports, . . .	3,609	391	92,594	10,325	16,412,746	1,343,020	199,469	47,705	. . . . .	. . . . .	16,708,418	1,401,441
Total, 1887. . .	76,062,878	4,860,382	15,735,239	1,370,657	480,845,811	37,303,997	16,910,513	3,133,300	3,248,826	156,579	592,803,267	46,824,915
Philadelphia, ...	39,908,874	2,530,308	5,084,609	378,773	99,698,916	7,825,976	1,607,476	112,671	371,742	16,220	146,671,617	10,863,948
New York, ...	45,517,847	3,238,053	6,943,325	607,800	320,197,058	25,466,617	20,813,863	3,758,841	808,038	52,654	394,280,131	33,123,965
Baltimore, ...	. . . . .	. . . . .	. . . . .	. . . . .	8,411,269	602,722	85,135	12,620	188,244	8,314	8,684,648	623,656
Boston.	. . . . .	. . . . .	5,563	1,004	5,178,583	402,757	181,093	35,913	. . . . .	. . . . .	5,365,239	439,674
All other ports. . . .	112,004	13,647	33,424	4,704	23,001,395	1,917,338	201,962	55,332	2,218	145	23,350,603	1,991,166
Total, 1888, . .	85,538,725	5,782,008	12,066,921	992,281	456,487,221	36,215,410	22,889,529	3,975,377	1,369,242	77,333	578,351,638	47,042,409

Philadelphia,	30,440,884	1,974,204	3,675,576	270,359	109,672,408	8,171,091	2,032,819	188,435	163,800	11,629	145,985,487	10,615,718
New York,	42,089,455	3,070,941	10,408,895	882,451	354,378,595	28,083,946	22,305,022	3,940,235	1,314,558	72,383	430,496,525	36,049,956
Baltimore,	.....	.....	.....	.....	6,521,873	452,637	454,343	55,573	176,820	9,595	7,153,036	517,805
Boston,	.....	.....	2,305	730	6,271,544	579,557	166,017	42,918	.....	.....	6,439,866	623,205
All other ports,	457,044	37,987	13,278	2,163	25,413,035	1,999,102	208,712	64,859	28,476	2,882	26,120,545	2,106,993
Total, 1889,	72,987,383	5,083,132	14,100,054	1,155,703	502,257,455	39,286,333	25,166,913	4,292,020	1,683,654	96,489	616,195,459	49,913,677
Philadelphia,	45,039,903	2,803,070	2,289,679	181,538	114,109,930	7,923,110	1,658,044	168,284	4,200	202	163,101,756	11,076,204
New York,	48,962,415	3,816,964	10,584,502	945,736	376,866,986	28,315,297	27,408,824	4,371,976	2,368,050	107,169	466,190,777	37,557,142
Baltimore,	.....	.....	.....	.....	10,963,213	545,177	802,482	145,454	272,150	12,580	12,037,845	703,211
Boston,	.....	.....	.....	.....	4,135,277	424,164	134,480	30,170	.....	.....	4,269,757	454,334
All other ports,	1,448,335	124,201	63,252	7,525	17,219,684	1,432,890	158,692	47,463	1,400	119	18,891,363	1,612,198
Total, 1890,	95,450,653	6,744,235	12,937,433	1,134,799	523,295,090	38,640,638	30,162,522	4,763,347	2,645,800	120,070	664,491,498	51,403,089
Philadelphia,	45,307,725	2,522,317	1,697,869	126,704	138,228,697	8,480,211	4,906,068	519,758	100,800	6,397	190,241,459	11,655,387
New York,	44,597,938	3,224,736	10,392,532	857,666	396,106,898	29,069,504	27,458,217	4,137,554	1,499,100	55,830	480,054,685	37,345,290
Baltimore,	.....	.....	.....	.....	14,709,003	739,405	821,024	107,158	259,050	10,734	15,789,077	857,297
Boston,	.....	.....	180	25	2,944,646	276,249	96,142	26,762	1,450	64	3,042,418	303,100
All other ports,	1,509,432	129,399	80,566	8,661	19,130,261	1,655,832	233,279	67,371	42,900	4,397	20,996,438	1,865,660
Total, 1891,	91,415,095	5,876,452	12,171,147	993,056	571,119,805	40,221,201	33,514,730	4,858,603	1,903,300	77,422	710,124,077	52,026,734
Philadelphia,	65,898,042	2,908,987	508,102	31,390	157,969,213	8,126,972	6,735,902	735,938	150	25	231,111,409	11,803,312
New York,	35,380,720	2,074,140	12,072,985	871,117	373,684,786	23,323,186	25,248,954	4,225,517	581,300	38,581	446,968,745	30,532,541
Baltimore,	.....	.....	.....	.....	10,615,959	417,810	1,091,105	139,515	.....	.....	11,707,064	557,325
Boston,	.....	.....	2,000	478	2,103,332	176,566	188,220	34,542	5,800	444	2,299,352	212,030
All other ports,	2,314,005	118,713	144,891	9,936	20,523,568	1,496,690	326,895	67,838	76,250	7,607	23,385,409	1,700,784
Total, 1892,	103,592,767	5,101,840	12,727,978	912,921	564,896,658	33,541,224	33,591,076	5,203,350	663,500	46,657	715,471,979	44,805,992

[TABLE SS.]

PETROLEUM EXPORTS BY GRADES, EACH YEAR, FROM JULY 1, 1863, TO JUNE 30, 1892.

YEAR ENDING JUNE 30.	CRUDE.		NAPHTHA.		ILLUMINATING.		LUBRICATING.		RESIDUUM.		TOTAL.	
	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.
1864.	9,980,654	3,864,187	438,197	154,091	12,791,518	6,764,411	. . . . .	. . . . .	. . . . .	. . . . .	23,210,369	10,782,689
1865.	12,293,897	6,868,513	480,947	173,943	12,722,005	9,520,957	. . . . .	. . . . .	. . . . .	. . . . .	25,496,849	16,562,413
1866.	16,057,943	6,015,921	673,477	188,825	34,255,921	18,626,141	. . . . .	. . . . .	. . . . .	. . . . .	50,987,341	24,830,887
1867.	7,344,248	1,864,001	224,576	34,175	62,686,657	22,509,466	. . . . .	. . . . .	. . . . .	. . . . .	70,255,581	24,407,642
1868.	10,029,659	1,564,933	1,517,268	267,873	67,909,961	19,977,870	. . . . .	. . . . .	. . . . .	. . . . .	79,456,888	21,810,676
1869.	13,425,566	2,994,404	2,673,094	445,770	84,403,492	27,636,137	134,532	51,122	. . . . .	. . . . .	100,636,684	31,127,433
1870.	10,403,314	2,237,292	5,422,604	564,864	97,902,505	29,864,193	6,871	2,611	. . . . .	. . . . .	113,735,294	32,668,960
1871.	9,859,038	1,971,847	7,209,592	746,797	132,608,955	34,138,736	59,632	22,660	155,474	14,770	149,892,691	36,894,810
1872.	13,559,768	2,307,111	8,092,635	932,160	122,539,575	30,566,108	541,419	211,287	438,186	41,724	145,171,583	34,058,390
1873.	18,439,407	3,010,050	9,743,593	1,487,439	158,102,414	37,195,735	748,699	277,966	781,074	79,566	187,815,187	42,050,756
1874.	17,776,419	2,099,696	9,737,457	1,038,622	217,220,504	37,560,995	1,244,305	404,243	1,827,798	142,299	247,806,483	41,245,815
1875.	14,718,114	1,406,018	11,758,940	1,141,440	191,551,933	27,030,361	1,173,473	313,646	2,752,848	187,103	221,955,308	30,078,568
1876.	20,520,397	2,220,268	14,780,236	1,442,811	204,814,673	28,755,638	963,442	303,863	1,581,401	193,206	243,660,152	32,915,786
1877.	26,819,202	3,756,729	15,140,183	1,816,682	262,441,844	55,401,132	1,601,065	497,540	3,196,620	317,355	309,198,914	61,789,438
1878.	26,936,727	2,694,018	16,416,621	1,411,812	289,214,541	41,513,676	2,304,624	639,381	3,968,790	316,087	338,841,303	46,574,974
1879.	25,874,488	2,180,413	15,054,361	1,258,780	331,586,442	35,999,862	2,487,681	655,468	3,307,038	210,726	378,310,010	40,305,249
1880.	28,297,997	1,927,207	18,411,044	1,192,229	367,325,823	31,783,575	5,162,835	1,039,124	4,767,000	276,490	423,964,699	36,218,625
1881.	39,984,844	3,065,464	17,292,310	1,693,975	332,283,045	34,317,695	4,852,203	1,054,064	3,247,860	184,411	397,660,262	40,315,609
1882.	41,304,997	3,129,511	20,313,098	1,809,143	488,213,033	44,588,854	5,508,100	1,492,396	3,716,362	212,802	559,954,590	51,232,706
1883.	52,712,306	3,914,941	17,070,537	1,302,286	419,821,081	36,926,574	10,182,342	2,326,632	6,145,356	442,646	505,931,622	44,913,079

1884, ...	67,186,329	5,302,974	15,045,411	1,072,651	415,615,693	38,195,349	10,515,535	2,179,595	5,297,124	352,679	513,660,092	47,103,248
1885, ...	81,037,992	5,903,853	15,822,853	1,272,290	458,243,192	40,074,827	13,092,483	2,632,883	6,561,660	374,114	574,628,180	50,257,947
1886, ...	80,246,763	5,859,577	12,311,197	997,420	469,471,451	40,634,331	12,526,069	2,519,615	3,226,272	188,901	577,781,752	50,199,844
1887, ...	76,062,878	4,860,382	15,765,239	1,370,675	480,845,811	37,303,997	16,910,513	3,133,300	3,248,826	156,579	592,803,267	46,824,963
1888, ...	85,538,725	5,782,008	12,066,921	992,281	456,487,221	36,215,410	22,889,529	3,975,377	1,369,242	77,333	578,351,638	47,042,409
1889, ...	72,987,383	5,083,132	14,100,054	1,155,703	502,257,455	39,286,333	25,166,913	4,292,020	1,683,654	96,489	616,195,459	49,913,677
1890, ...	95,450,653	6,744,235	12,937,433	1,134,799	523,295,090	38,640,658	30,162,522	4,763,347	2,645,800	120,070	664,491,498	51,406,089
1891, ...	91,415,095	5,876,452	12,171,147	993,056	571,119,805	40,221,201	33,514,759	4,858,603	1,903,300	77,422	710,124,077	52,026,734
1892, ...	103,592,767	5,101,840	12,727,978	912,921	564,896,658	33,541,224	33,591,076	5,203,350	663,500	46,657	715,471,979	44,805,992

[TABLE TT.]

PETROLEUM EXPORTS FROM PHILADELPHIA, SHOWING QUANTITIES AND VALUES OF EACH GRADE, FROM JULY 1, 1863, TO JUNE 30, 1892.

YEAR ENDING JUNE 30.	CRUDE PETROLEUM.		REFINED PETROLEUM.								TOTAL.	
			NAPHTHAS.		ILLUMINATING OILS.		LUBRICATING OILS.		RESIDUUM.			
	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.	Gallons.	Dollars.
1864,	2,087,114	670,774	18,167	4,842	2,878,148	1,413,597	None.	None.	None.	None.	4,983,429	2,089,213
1865,	1,110,907	488,751	43,992	9,640	3,886,019	2,704,960	"	"	"	"	5,040,918	3,203,351
1866,	5,096,037	1,639,991	164,198	25,771	16,701,452	8,864,555	"	"	"	"	21,961,687	10,530,317
1867,	3,047,117	658,875	117,977	13,989	26,717,294	9,479,274	"	"	"	"	29,882,388	10,152,138
1868,	3,778,871	622,677	1,144,481	196,915	28,738,410	8,035,771	"	"	"	"	33,661,762	8,855,363
1869,	1,409,603	289,202	2,313,675	384,560	33,037,974	10,397,507	"	"	"	"	36,761,252	11,071,269
1870,	3,005,916	608,415	360,054	36,948	36,147,670	11,016,757	"	"	"	"	39,513,640	11,662,120
1871,	2,588,007	442,944	760,243	73,776	49,428,659	12,266,195	"	"	"	"	52,776,909	12,782,915
1872,	5,951,795	999,064	1,237,767	156,204	48,763,900	11,566,468	36	45	69,676	6,352	56,023,176	12,728,133
1873,	4,981,872	821,449	1,686,577	242,852	62,420,325	13,825,920	4,773	1,265	395,262	40,827	69,488,809	14,932,313
1874,	4,395,953	473,020	1,593,398	157,612	81,950,259	13,258,005	13,944	2,189	134,400	11,388	88,087,954	13,902,214
1875,	3,662,247	324,116	1,830,396	147,018	52,411,429	6,724,172	200	50	304,752	17,353	58,209,324	7,212,709
1876,	8,663,564	873,592	3,250,942	294,492	60,770,244	7,958,189	20,998	5,369	278,166	19,736	72,983,914	9,151,378
1877,	4,262,093	558,101	3,499,300	378,412	50,823,652	10,757,806	22,269	6,143	466,368	43,142	59,073,682	11,743,604
1878,	4,809,278	471,871	1,994,067	156,796	40,795,553	5,605,117	28,697	8,037	178,878	13,598	47,806,473	6,255,419
1879,	4,687,786	377,197	2,729,037	207,928	76,307,729	7,795,749	7,182	3,367	144,564	7,952	83,876,298	8,392,193
1880,	2,730,147	160,549	2,366,622	148,464	77,083,630	6,234,608	34,943	6,980	395,094	28,161	82,610,936	6,578,762

1881.	5,326,528	351,736	1,084,324	95,516	55,076,090	5,480,763	154,836	30,199	. . . . .	. . . . .	61,641,778	5,958,214
1882.	4,454,946	288,581	3,172,703	273,848	116,322,337	9,993,305	764,363	134,443	109,410	7,258	124,823,759	10,697,435
1883.	6,959,240	460,857	1,752,328	104,117	65,212,757	5,567,659	963,602	163,720	240,366	15,882	75,128,293	6,312,235
1884.	5,557,310	400,833	854,219	49,052	75,919,774	6,935,975	998,373	198,428	176,736	9,050	83,506,412	7,593,338
1885.	29,542,316	2,082,561	5,726,160	406,263	111,705,564	9,264,065	582,241	90,560	1,278,480	63,137	148,834,761	11,906,586
1886.	33,452,742	2,327,344	4,866,220	344,925	116,126,657	9,628,165	288,465	43,445	840,042	52,480	155,574,126	12,396,359
1887.	35,892,185	2,204,847	4,945,780	393,632	113,959,691	8,566,164	276,858	38,559	1,445,430	68,924	156,519,944	11,272,106
1888.	39,908,874	2,530,308	5,084,609	378,773	99,698,916	7,825,976	1,607,476	112,671	371,742	16,220	146,671,617	10,863,948
1889.	30,440,884	1,974,204	3,675,576	270,359	109,672,408	8,171,091	2,032,819	188,435	163,800	11,629	145,985,487	10,615,718
1890.	45,039,903	2,803,070	2,289,679	181,538	114,109,930	7,923,110	1,658,044	168,284	4,200	202	163,101,756	11,076,204
1891.	45,307,725	2,522,317	1,697,863	126,704	138,228,997	8,480,211	4,906,068	519,758	100,800	6,397	190,241,453	11,655,387
1892.	65,898,042	2,908,987	508,102	31,390	157,969,213	8,126,972	6,735,902	735,938	150	25	231,111,409	11,803,312

[TABLE UU.]—EXPORTS OF PARAFFINE AND PARAFFINE WAX, FROM JULY 1, 1880, TO JUNE 30, 1892.

(Compiled from data United States Treasury Department.)

YEAR ENDING JUNE 30.	Pounds.	Dollars.
1881,	5,369,821	437,187
1882,	9,121,161	579,131
1883,	14,228,551	936,885
1884,	17,089,817	1,263,197
1885,	24,378,488	1,725,344
1886,	24,289,693	1,729,313
1887,	31,546,223	2,032,713
1888,	36,005,522	2,168,247
1889,	33,826,575	2,029,602
1890,	48,516,551	2,408,709
1891,	66,366,003	3,714,649
1892,	64,998,867	3,965,263

[TABLE VV.]

AVERAGE MONTHLY AND YEARLY EXPORT PRICES OF CRUDE OIL PER GALLON, IN BARRELS, AT NEW YORK, FROM JANUARY 1, 1863, TO DECEMBER 31, 1892.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
1863 *	$0 24	$0 23	$0 22	$0 21 5/8	$0 26 1/4	$0 27 5/8	$0 30 3/4	$0 35 1/4	$0 36	$0 33 3/4	$0 28 1/4	$0 30 3/4	$0 28 1/8
1864, *	31 1/8	30 3/8	31 3/8	37 1/8	38 1/4	44 7/8	52 3/8	52 5/8	45 1/2	41 1/4	45 5/8	51 7/8	41 7/8
1865, *	49 1/2	47 5/8	37	35 3/4	36	34 5/8	32 7/8	32	35 5/8	38 1/8	38 3/4	41 1/2	38 1/4
1866, *	34 7/8	30	25 1/8	24 5/8	27 3/4	25 1/2	22 5/8	26 3/4	26 5/8	23 1/4	22 1/4	19 1/2	25 1/4
1867, *	13 3/8	12 5/8	11 1/4	11	10 1/2	8 3/4	13	12 7/8	14 3/8	14 1/2	12 1/4	10 3/8	12 1/8
1868,	16 1/8	17	17 3/8	16 1/2	18 3/8	19 3/8	22 3/8	21 5/8	20 7/8	21 1/8	21 1/8	23 1/4	19 3/8
1869,	24 5/8	26	22 3/4	22 3/4	21 3/4	21 1/8	23	23	33	23 7/8	25 1/2	21 1/2	23 3/4
1870,	21 1/4	21 1/2	19 3/4	19 3/8	19 7/8	18 5/8	17 3/4	16 1/2	17 1/2	16 1/4	16 1/4	16 3/8	18 1/2
1871,	18 1/8	18 3/4	18 1/2	17 3/8	18 1/2	19 1/2	18 3/4	17 3/4	18	18	16 3/4	17 1/8	18 1/8
1872,	16 5/8	16 1/2	16 1/2	15 7/8	16 7/8	16 1/2	15 7/8	14 1/4	15 1/4	17 1/4	17 3/8	15 5/8	16 1/4
1873,	12 3/4	11 7/8	11 3/4	12 3/8	12 1/2	11 5/8	10 7/8	9 5/8	8 7/8	8 3/8	8 1/2	8 3/8	10 3/8
1874, *	6	7 3/8	7	7 3/8	6	5 1/8	5	5 1/8	5 1/8	5 3/4	5 1/8	5 3/8	6
1875, *	6 1/8	7 3/8	7 3/8	6 7/8	6 1/4	6 3/8	5 1/2	5 1/2	6	6 3/4	6 3/4	7 1/8	6 1/2
1876, *	8	8 1/2	8 3/8	8 1/2	8 1/2	8 3/4	9 3/8	11 1/2	14 1/2	13 1/8	12 1/8	15 1/2	10 1/2
1877, *	14 1/2	11	10 3/8	10 1/2	8 1/2	7 1/4	7	7 3/8	7 7/8	8 1/2	8	8	9 1/8
1878, *	7	7 1/2	7 1/2	6 3/4	7 1/8	7 1/2	6 1/2	6 1/8	5 3/8	5 1/8	5 1/4	. . . . .	7 1/4
1879, *	. . . . .	. . . . .	5 1/8	5	4 3/8	3 1/2	2 1/2	2 3/4	2 1/2	3 1/4	3 7/8	. . . . .	3 3/8
1880,	6 7/8	6 3/4	6 3/8	6 7/8	6 3/8	6 3/8	7	6 5/8	6 1/2	6 5/8	6 1/2	6 1/8	6 3/8
1881,	6 5/8	7	6 3/4	5 7/8	5 7/8	6 1/4	6 1/4	6 1/4	7	6 3/4	6 1/2	6 3/8	6 3/8

* In bulk.

[TABLE VV—*Concluded*.]

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
1882,	$0 65/8	$0 65/8	$0 67/8	$0 67/8	$0 63/8	$0 61/4	$0 6	$0 6	$0 61/4	$0 63/4	$0 71/4	$0 73/8	$0 65/8
1883,	63/4	67/8	7	71/8	63/4	65/8	65/8	65/8	71/4	74	73/8	71/4	71/4
1884,	73/8	73/4	75/8	73/8	71/4	63/4	65/8	63/4	61/4	61/4	63/8	61/4	7
1885,	61/4	65/8	7	63/4	63/4	63/4	71/4	71/4	71/4	71/4	71/4	65/8	7
1886,	63/4	63/8	63/8	61/8	61/8	6	6	6	53/8	61/4	61/8	61/4	61/4
1887,	61/8	6	53/4	6	53/8	53/4	53/4	53/4	53/8	6	61/4	61/4	53/4
1888,	63/4	63/4	63/4	65/8	61/4	61/4	63/8	65/8	65/8	63/8	65/8	65/8	65/8
1889,	61/4	65/8	63/8	61/4	61/4	65/8	63/4	7	7	7	71/8	71/4	63/4
1890,	73/4	73/4	71/4	71/4	73/8	73/8	73/8	71/4	71/4	71/4	71/4	7	73/8
1891,	71/8	71/4	7	63/4	63/4	63/8	61/4	53/4	51/4	53/8	51/4	53/8	61/4
1892,	51/4	53/8	53/8	53/8	53/8	51/4	53/8	51/4	51/4	53/8	53/8	53/8	53/8

[TABLE WW.]

AVERAGE MONTHLY AND YEARLY EXPORT PRICES OF NAPHTHA, PER GALLON, IN BARRELS, AT NEW YORK, FROM JANUARY 1, 1863, TO DECEMBER 31, 1892.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
1863.	$0 33	$0 36¾	$0 40⅛	$0 28⅝	$0 28½	$0 26	$0 24⅓	$0 22⅝	$0 27	$0 27⅝	$0 24⅓	$0 23⅝	$0 28½
1864.	24⅝	24½	25⅝	35⅜	36	36½	42½	49¾	50½	47½	51	51⅝	39½
1865.	56½	54	51¼	46⅞	48¼	49½	49¼	45⅝	48½	52	53	50	50¾
1866.	44	40¾	38	38¾	39⅜	38	38	31⅝	28	27½	26½	26	37⅞
1867.	25	22½	20⅛	21½	21½	21⅜	21⅝	21	21½	27	30⅜	31⅝	23¾
1868.	30½	28¾	26⅝	18	14¼	14⅝	19⅛	17¼	15½	14⅛	12½	15½	19
1869.	11⅝	12½	9	9⅜	10	10	9⅞	9⅜	10½	10⅞	10⅛	10⅛	10⅜
1870.	10½	10⅞	10	10	9⅞	9⅝	9½	9⅜	10⅜	9⅝	10	9½	9⅞
1871.	9⅝	10¼	9⅜	8⅜	8⅝	9¼	10	9⅜	10	10⅝	11	12	10
1872.	12⅜	11⅝	10¼	10⅜	15½	17½	14¾	14⅞	16⅛	19	18⅝	17⅛	14¾
1873.	15½	14	12⅝	11½	11	10⅝	10	9⅜	10½	10	9¼	8⅝	11⅛
1874.	8⅜	8½	9	9¼	8⅝	7½	7¾	8¾	10½	9¾	10⅜	10⅜	9
1875.	9¾	9¾	10	9¾	9⅜	8⅞	8⅝	9½	10½	11	10½	9¼	9⅝
1876.	9⅜	9¾	10	10	9⅜	9½	10⅜	11⅜	14⅛	14	14⅜	. . . . .	11⅜
1877.	14⅜	12¾	11⅜	10	9½	9⅜	9¼	8¼	7¾	7½	7½	7½	9¾
1878.	7	7	7	6½	6½	6½	7	8	8	8	8⅛	8¼	7⅛
1879.	8	8	8	8	8	6⅞	5½	5	5	5⅝	6½	6¾	6½
1880.	6¾	6½	6	5⅜	5½	6⅛	7⅛	7½	10⅛	11	10⅝	10¾	7¾
1881.	10⅜	11⅓	10¾	8	8⅜	9	9⅜	10	10	10	9¾	8⅜	9⅜
1882.	6½	6½	6⅜	6⅜	6⅜	6	6	5½	5¾	6¾	6¾	6½	6¼
1883.	6¾	6⅜	6⅜	6½	5⅝	5⅛	5	5	5½	5¾	6	6½	5⅞

[TABLE WW—*Concluded.*]

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
1884	$0 7	$0 7½	$0 7½	$0 7½	$0 7½	$0 7½	$0 7½	$0 7½	$0 7½	$0 7½	$0 7½	$0 7½	$0 7½
1885	7½	7½	7	6½	6⅝	6⅝	6⅝	7	7	7½	7⅝	8	7⅛
1886	8	8¼	8¼	8¼	8¼	8¼	8¼	8¼	8¼	8¼	8¼	8¼	8¼
1887	8¼	8¼	7⅞	7½	7¾	7¾	7¾	7⅞	7⅞	7⅞	7⅞	7½	7¾
1888	7	7	7	7	7	7	7⅛	7½	7⅞	7½	7¾	7¾	7½
1889	7¾	7¾	7¾	7¾	7¾	7¾	7¾	7⅞	7⅞	8	8	8¼	7⅞
1890	8¼	8¼	8⅛	7⅝	7⅜	7⅜	7⅜	7⅜	7⅜	7½	7½	7½	7½
1891	7⅛	7	6⅞	6⅜	6¼	6	5⅝	5¾	5¾	5¾	5¾	5⅝	6⅛
1892	5½	5½	5½	5	5	5	5	5	5	5½	5½	5½	5⅜

[Table XX.]

Average Monthly and Yearly Export Prices of Refined Oil, per Gallon, in Barrels, at New York, from January 1, 1861, to December 31, 1892.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Yearly.
1861.	$0 78½	$0 79½	$0 72⅛	$0 66¾	$0 62¾	$0 59	$0 50¾	$0 58¾	$0 58	$0 55	$0 48½	$0 48½	$0 61½
1862.	40	32½	30	27½	25	26½	30	34	34¾	36½	60¾	59¾	36⅜
1863.	40	38¼	34⅜	33¼	39⅜	44⅜	49	53½	57¾	52½	41⅝	45½	44¾
1864.	46⅝	47⅛	49⅛	54⅛	59½	68⅞	86⅛	84⅞	75	64	68⅝	72⅜	65
1865.	70	67¼	58¾	52⅞	51⅛	51½	52⅛	52	58¼	61¾	62⅜	65¼	58¾
1866.	57⅞	48⅝	41⅞	40⅛	43	41⅞	39½	44⅜	44⅝	40⅝	35¾	31½	42½
1867.	28¼	28⅜	27½	27⅛	26¾	21⅞	30⅝	29⅛	34⅛	34½	28	23⅛	28⅜
1868.	24¾	25	25⅝	26¼	29⅝	31⅜	34¼	33	31	30	30⅞	32¼	29½
1869.	34⅛	36⅜	32⅛	32½	31½	31	32½	32½	32¼	32⅞	34	31⅛	32¾
1870.	31⅝	29⅞	27	26½	27½	27	26	25	26⅛	24⅝	23	23	26⅝
1871.	24⅜	25⅛	24⅛	23½	24⅝	25¾	25⅜	24⅜	24⅛	23¾	22⅜	23	24¼
1872.	22⅝	21¾	22⅜	21¾	23⅜	23	22⅜	22⅜	24⅛	26	27	26	23⅜
1873.	22⅛	19⅝	19	20	19¾	19	18⅛	16½	16½	16¼	14⅛	13½	17⅞
1874.	13½	15	14⅞	15⅝	13⅞	12⅞	12⅛	11⅜	12⅛	11⅞	10⅜	11¼	13
1875.	12⅝	14	15	13⅞	12¾	12⅝	11⅓	11¼	12¾	14⅛	13	12⅜	13
1876.	14⅛	14⅛	14½	14	14⅛	14⅜	16⅜	19⅞	26	26	26½	29⅜	19⅛
1877.	24	18⅝	16	15¾	14½	13¾	13⅜	13⅝	14½	14⅝	13½	13⅛	15½
1878.	12⅛	12⅛	11⅝	11⅜	11¼	11¼	10⅜	10⅜	10¼	9⅝	9⅛	8⅜	10¾
1879.	9	9½	9⅛	9¼	8½	7¾	7⅞	6½	6¾	7½	8¼	8½	8¼

[TABLE XX—*Concluded.*]

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December	Yearly.
1880	$0 07 3/8	$0 07 1/4	$0 07 3/4	$0 07 5/8	$0 07 5/8	$0 08 3/4	$0 09 3/4	$0 09	$0 10 5/8	$0 11 1/4	$0 10 1/4	$0 09 1/2	$0 09
1881	8 7/8	9 1/8	8 7/8	7 7/8	8	8 1/8	7 7/8	7 5/8	8	7 3/4	7 1/2	7	8
1882	7	7 3/8	7 3/8	7 3/8	7 3/8	7 3/8	6 7/8	6 3/4	7 1/4	7 3/8	8 1/4	7 1/2	7 3/8
1883	7 1/2	7 3/4	8	8 1/4	7 5/8	7 3/4	7 3/8	7 1/2	8 1/8	8 3/8	8 5/8	9 1/8	8
1884	9 3/8	8 7/8	8 3/8	8 1/2	8 3/8	7 7/8	7 3/4	7 7/8	7 3/4	7 3/4	7 5/8	7 3/4	8 1/8
1885	7 1/2	7 1/2	7 3/4	7 3/4	7 1/2	7 7/8	8 1/4	8 3/8	8 3/8	8 1/2	8 3/8	7 7/8	8
1886	7 3/4	7 1/2	7 1/4	7 1/4	7 1/8	7 1/8	7	6 7/8	6 5/8	6 3/4	7	6 3/4	7 1/8
1887	6 3/4	6 5/8	6 5/8	6 5/8	6 3/8	6 3/4	6 1/2	6 1/2	6 5/8	6 3/4	7	7 1/4	6 3/4
1888	7 3/4	7 3/4	7 3/4	7 3/8	7 1/2	7 1/8	7 3/8	7 5/8	7 3/4	7 5/8	7 1/4	7 1/4	7 1/2
1889	7	7 1/8	7	6 7/8	6 7/8	6 7/8	7 1/4	7 1/4	7 1/8	7 1/8	7 1/2	7 1/2	7 1/8
1890	7 1/8	7 1/2	7 1/4	7 1/8	7 1/4	7 1/8	7 1/8	7 1/4	7 3/8	7 1/2	7 1/2	7 1/4	7 3/8
1891	7 3/8	7 1/2	7 3/8	7 1/8	7 1/4	7 1/8	7	6 3/4	6 3/8	6 3/8	6 3/8	6 1/2	6 7/8
1892	6 1/2	6 3/8	6 1/4	6 1/8	6	6	6	6 1/8	6 1/8	6	5 3/4	5 1/2	6

[TABLE YY.]—TABLE SHOWING THE CORRESPONDING REAL SPECIFIC GRAVITY AND WEIGHT OF ONE GALLON OF REFINED OIL AT 60° TEMPERATURE, FOR EACH DEGREE OF THE BAUMÉ SCALE.

BAUME' SCALE.	SPECIFIC GRAVITY.	WEIGHT OF ONE GALLON.	BAUME' SCALE.	SPECIFIC GRAVITY.	WEIGHT OF ONE GALLON.
Degree.	*Degree.*	*Pounds.*	*Degree.*	*Degree.*	*Pounds.*
10, ...	1.0000	8.331	50.	.7777	6.493
11, ...	.9929	8.273	51.	.7734	6.458
12, ...	.9859	8.215	52, ...	.7692	6.424
13, ...	.9790	8.157	53, ...	.7650	6.390
14, ...	.9722	8.099	54, ...	.7608	6.355
15.	.9655	8.046	55, ...	.7567	6.321
16, ...	.9589	7.993	56, ...	.7526	6.287
17, ...	.9523	7.939	57, ...	.7486	6.255
18, ...	.9459	7.886	58, ...	.7446	6.223
19, ...	.9395	7.833	59, ...	.7407	6.192
20, ...	.9333	7.780	60, ...	.7368	6.160
21.	.9271	7.731	61.	.7329	6.129
22, ...	.9210	7.683	62, ...	.7290	6.097
23.	.9150	7.634	63, ...	.7253	6.066
24, ...	.9090	7.585	64, ...	.7216	6.034
25, ...	.9032	7.537	65, ...	.7179	6.002
26, ...	.8974	7.489	66, ...	.7142	5.972
27.	.8917	7.440	67, ...	.7106	5.943
28, ...	.8860	7.391	68, ...	.7070	5.913
29, ...	.8805	7.343	69, ...	.7035	5.883
30, ...	.8750	7.294	70, ...	.7000	5.853
31, ...	.8695	7.249	71, ...	.6965	5.823
32, ...	.8641	7.206	72, ...	.6930	5.795
33, ...	.8588	7.162	73, ...	.6896	5.768
34, ...	.8536	7.118	74, ...	.6863	5.739
35, ...	.8484	7.075	75, ...	.6829	5.711
36.	.8433	7.034	76, ...	.6796	5.684
37, ...	.8383	6.994	77, ...	.6763	5.656
38, ...	.8333	6.953	78, ...	.6730	5.628
39, ...	.8284	6.914	79, ...	.6698	5.600
40, ...	.8235	6.874	80.	.6666	5.573
41, ...	.8187	6.835	81, ...	.6635	5.545
42, ...	.8139	6.796	82, ...	.6604	5.514
43, ...	.8092	6.756	83, ...	.6573	5.484
44, ...	.8045	6.717	84, ...	.6542	5.454
45, ...	.8000	6.679	85.	.6511	5.424
46.	.7954	6.641	86, ...	.6481	5.399
47, ...	.7909	6.604	87, ...	.6451	5.374
48, ...	.7865	6.567	88, ...	.6422	5.350
49, ...	.7821	6.530	89, ...	.6392	5.325
			90, ...	.6363	5.301

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It is not our purpose to attempt to give a complete list of the books and articles on petroleum and its manufacture. Were it possible to prepare such a catalogue, space could not be spared to print it. We append simply the titles of the books and articles that, directly or indirectly, have been of assistance in the preparation of this report:

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